A String of Pearls

A Dyson Sphere Science Fiction novel based on *Hard Science*.

(*Hard Science* is real science and not fantasy.)

by Patrick Bruskiewich

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Prize Winning Novel for the 2023 Dyson Sphere Science Fiction Contest

A String of Pearls

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pbruskiewich @ gmail.com.

Synopsis

A set of seven objects is discovered by a young astrophysicist orbiting in the Oort Cloud. The objects include a Dyson Sphere which also can be used as a stellar engine to move from one star system to another.

The surface of the Dyson Sphere is a Graphene-Gold composite structure that can be modified to meet the specific needs of the system at any particular time. The physics of a stellar engine using a solar sail is described within the body of this novel.

The entire object is described as a *String of Pearls* and is the home of planet builders and a very sophisticated and peace loving civilization that are harbingers of life throughout the Milky Way Galaxy.

They have built several planets while in orbit around the Sun. Two earthlings are invited to join them as a new planet and the life thereon is transported to a newly formed G type star.

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Many Billion of years ago the Milancovitch Cycles began. The Milancovitch Cycle, which has a period of 405,000 years, varies the Earth's orbit from being circular to being slightly eccentric.

To coincide with the onset of the Milancovitch Cycles, an object with a mass many times that of Jupiter entered a circular orbit around the Sun at a distance of 2,172 A.U.

It continues to orbit within the Oort Cloud.

What this object is, and what is it purpose, has yet to be fully explained!

Chapter 1 – A String of Pearls

When they wouldn’t let him use the supercomputer at the Astrophysics Institute he decided to build his own. He had initially contemplated trying his hand at constructing a room temperature diamond based hexadecimal Qubit quantum computer, but after a few days he reluctantly decided against it. After all, he figured he needed only a half dozen months of computing time to do his latest astrophysics project. When he sat down and thought the whole research project through he estimated that it would take him as long just to design-build a room temperature Qubit supercomputer ... so why bother? A room temperature Quantum bit computer can be a future project.

Cold soaked MOSFET based technology would be enough for his immediate needs provided he made the code RISC (Reduced Instruction Set Computing), and provided he could sufficiently cool his supercomputer array. It took him three months of twenty four-seven work to design-build his 3 by 3 by 3 parallel programming array.

He decided to call his machine HGIPSY because it had a hundred billion instructions per second capability … and because he considered himself somewhat of a bohemian.

To cool HGIPSY down he originally thought he might use a closed circuit, supercooled organic solvent, but after a quick calculation he realized a good conventional freezer might be adequate. He might have to cycle through batches of computations and every seventy two hours set the system to standby as the HGIPSY returned to cool mode. So out he went in search for an old industrial kitchen freezer.

The freezer he procured was twenty times bigger that HGIPSY, but that seemed to be the norm for most high speed computer systems. When it was delivered his mom thought he was being a bit more eccentric than usual standing beside the stainless steel behemoth. With computer arrays the support equipment were always the headache. But he chose wisely and his cooling system turned out to be adequate for one hundred hours of normal calculations or sixty five hours of concerted number crunching. It was not what he had planned for but it would have to do!

He had to hire some strong men to manhandle the freezer into his workroom. The stairs creaked as the giant stainless steel box was slowly carried up to the second floor. When it was in place they had to run a special 240 Volt feed on its own breaker and a signals-conditioned power feed to HGIPSY. The stability had to be better than one part in ten to the fifth otherwise it would introduced flipped bits and glitches.

Inside the freezer he isolated HGIPSY using a carbon composite harness to reduce stray charge and nine electro-optical connections, sealed the freezer shut and then filled its inner volume with dry nitrogen gas. He tested the feeds arduously, then when they passed the tests he turned the temperature down to its lowest setting. Along with providing cooling the freezer also acted like a Faraday cage. He did not want any stray microwave signals to cause glitches or flip bits either.

On the sixteenth week of effort he started his parallel processing array for the first time. His first runs of data were for validation – a standard search for prime numbers from 1 to 100 billion. He could easily sort out HGPISY's performance in this simple fashion. Then he took a Sunday off, happy with his creation, to catch up on his sleep.

For four months he had been like Michelangelo chipping at the marble, fixated on his work producing his monumental masterpiece. Now his David stood before him, a shiny rectangle much taller than him that purred when the refrigerator ran and was as quiet as a tomb when it did not.

During the day on Monday he set in the new code, then later in the evening opened up and started to use a pipeline he had already set up to the Astrophysics computer and its data base.   There might be eight to ten hours before they found him out and perhaps shut the feed. He felt lucky. He routed through an asymmetric algorithm that used nodes scattered around the United States. As long as he stayed continental what could they really do but set the F.B.I onto him. And since he wasn't hacking vital infrastructure of financial services why would they even bother?.

For nine hours and twelve minutes he fed existing data about long period comets and their trajectories before the pipeline was shut off. For most of Tuesday he compared his results to that from the standard calculations done at the Astrophysics lab. When the validation showed his HGIPSY was performing up to its potential, that evening using a different pipeline he started to mine the astrophysics data for the Oort Cloud. The structure and dynamics of the Oort Cloud was one of his special interests.

He was an unorthodox thinker and this is why he enjoyed *Phenomenology*. When he came across its meaning for the first time it seemed mystical to him:

> *Phenomenology* is a philosophy used in theoretical physics and astrophysics by which the analysis of data allows predictions to be made about unknown phenomenon. *Phenomenology* is a philosophical conception or belief that there is a relationship between cause and effect and that predictions can be made to describe anticipated effects or real phenomena, without necessarily fully understanding the underlying cause.

It was obvious to him that mathematics is the language of *Phenomenology*. It did not take him long to realize that in ancient times Pythagoras was *Phenomenology's* first and greatest champion and in more modern times it was Albert Einstein. It was now his turn! Perhaps he would be it's contemporary champion?

What he was working on was a *Phenomenological* study of the Oort Cloud. He was curious to find any structures that might be similar to the Kirkwood gaps in the asteroid belt, or the Kuiper cliff and distribution gaps past Neptune. He had asked politely and so the scientists at the Astrophysics lab knew what it was he ultimately wanted to do. He patiently explained what his research work was about … but they turned him down. He wasn't a real astrophysicist they said, he was just a boy!

The second time he did a deep incursion into the Astrophysics lab's database they knew he was there, yet someone nonetheless left the pipeline open for him. It wasn't as if he was hacking. He left them enough bread crumbs for them to know it was him … they knew he was on a mission to discover something new. One of his friends at the lab had obviously gone to bat for him. Sure, he was persistent, and stubborn, you had to be when you were a genius and so young, yet he was harmless. If he discovered some remarkable *Phenomenon* perhaps they too would bask in his glow.

Last December it was he that had noticed an anomaly at the inner edge of the Oort Cloud, an anomaly that defied conventional wisdom. Most other *Oorties*, as Oort cCoud researchers were called, focused on the structure of the Oort cloud along the ecliptic plane of the solar system. He, instead, focused on the structure perpendicular to the ecliptic. From a research standpoint he knew there might be greater riches in his search perpendicular to the ecliptic, compared to searches along the ecliptic plane of the solar system.

He was not disappointed. In a section of the Oort cloud, perpendicular to the orbit of Neptune, and at a greater distance than Neptune's orbit from the Sun, he had come across a strange structure.

The strange structure was like a *string of pearls*, starting with a small object, than a second larger object, than a third larger than the second and a fourth that was the largest structure of the group, then a tapering back to the smallest but in reverse order. Seven objects in all, in a perfectly circular orbit, at 2,172 Astronomical Units from the Sun. What it was and how it got there he did not have even the faintest clue.

This structure defied even the stability theory of Lagrange Points. Surrounded by the many objects within the Oort Cloud, this strange *string of pearls* should not be stable, but should scatter apart and fill in its wake with Oort Cloud material. Astonishingly, the nearest he could make out, not only was this strange *string of pearls* phenomenon stable but it had cleared a toroid in the Oort cloud that itself had an interesting configuration.

He did a search for secondary structure. Finding the strange *string of pearls* structure had been complete serendipity, but modeling how it was affecting its surroundings required more than just good fortune.

That's why he built his super computer. That is why he had written a long and complicated algorithm. Now, with his HGIPSY, he had plenty of high-speed computing capability to search for secondary structure.   So he let HGIPSY crunch on the numbers as he toddled off to do his high school final exams. He smiled to himself … this research is something most people would not expect from a ten year old, even if he had skipped several grades and was soon to set off for university.

As he walked to school he set out to sort out what this object's orbital period was. It was easy for him to do this calculation now that he knew the distance the *object* was from the Sun. He applied Kepler's Third Law and set out to calculate the period

$$\tau^2 = \frac{4\pi^2}{G\, M_{sun}}\, R^3$$

It was quick and easy if you did this calculation in terms of the period and distance of the Earth from the Sun, namely

$$\tau_{SoP}^2 = \tau_{Earth}^2\, \frac{R_{SoP}^3}{R_{Earth}^3} = \; 2172^3$$

which yielded an orbital period of 101,225 years. He stopped, opened his back pack, extracted his notebook and wrote this down in his notebook and drew a dark circle around the number. Then he closed his note book, put it back into his back pack and continued on deep in thought. Surely this must lead to new Phenomenon he thought.

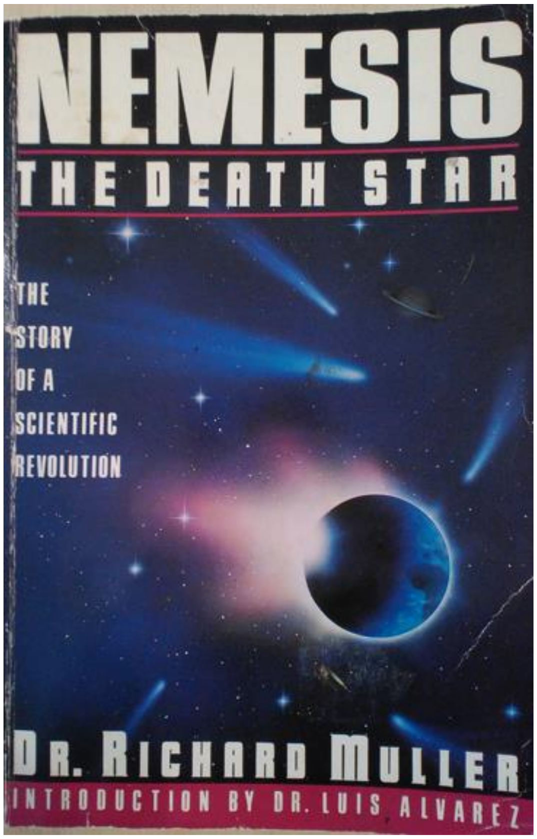
It annoyed him that the astrophysicists at the Institute wouldn't take him seriously because he was so young! He smiled thinking … after all … it was they who were acting like children.

When he arrived at his school that morning he paused at the front steps, oblivious to the much older kids milling around him. Thomas smiled to himself. His philosophy was to be true to himself, to search for the truth where ever it may lead and, if need be, to create his own existence. As he ascended the stairs he thought perhaps one day his name Thomas Tipler, will be as well-known as Pythagoras or Albert Einstein!

Chapter 2 – A New Nemesis

When she was a little girl Sally had bought a book at a book sale for 10 cents at her community library. It was a strange choice for her first astronomy book and she struggled to read and understand what it was about.

The book was written by Dr. Richard Muller and called *Nemesis: The Death Star*. The foreword was by Nobel Physics Prize winner Dr. Luis Alvarez.


NEMESIS
THE DEATH STAR
THE STORY OF A SCIENTIFIC REVOLUTION
DR. RICHARD MULLER
INTRODUCTION BY DR. LUIS ALVAREZ

Richard Muller speculated about a rogue star in a distant orbit around the sun, which triggered objects to fall out of the sky onto Earth every twenty-six million years. In turn he speculated that this was the cause of some of the more prominent mass extinctions on Earth.

When her classmates were learning about dinosaurs Sally was learning about what might have caused their extinction … bolides that fell from outer space. She didn't just draw pictures of giant dinosaurs among the behemoth trees and bushes, Sally drew pictures of the dumb and unknowing dinosaurs looking up into the sky at a blazing object crashing down on them from the heavens.

When her teachers saw what she was doing they took fright of her drawings and sent Sally to the school psychologist. Why her teachers did this confused and bemused her at the same time. So she had to sit in the tiny quiet, creepy office and explain patiently to the school psychologist that it was physicist Dr. Luis Alvarez who assayed the isotope Iridium to support the '*It Came from Outer Space*" that caused the mass extinctions of life on Earth.

The school psychologist had never heard of Dr. Luis Alvarez, nor his Nobel Prize in Physics, and did not know what the isotope Iridium was nor what an isotopic assay was. What angered Sally is the school psychologist tried to remediate her behavior … well having looked up the word remediate, it was Sally who did the remediation.

So she patiently explained the science to the school psychologist. Sure Sally was only ten at the time and real science was not yet even being taught at her school, but somehow as she struggled to understand *Nemesis: The Death Star*, in her bones and in her heart she knew that one day she would be a scientist.

Her classmates called her a geek … an astro-geek … a space cadet … and sometimes even worst. But Sally grew a thick skin and went about walking her own path, doing her own thing. She got her first telescope for Christmas that year, a 50 mm refractor which was just good enough to make out the moons of Jupiter, the rings of Saturn, the poles on Mars and most of the interesting craters on the moon.

Around that time she became an '*Astro-geek*' she also started to read science fiction and watch vintage Sci Fi films. She remembered reading hundreds of short stories by Isaac Asimov and Arthur C. Clarke, taking particular interest in the fact that Asimov was a Ph.D. chemist and Clarke an electrical engineer. She enjoyed watching *2001 a Space Odyssey* on the big screen, and then a few decades later *2010: The Year We made Contact*. Sure she saw all the other Sci Fi classics from the 1950's, *War of the Worlds*, *It Came From Outer Space* and *Forbidden Planet*, but she drew the line at *Godzilla*, *Invasion of the Body Snatchers* and other zombie outer space or atomic disaster films. She was hooked on 'Hard Science' – Science Fiction that was based on plausible science, and not the moronic *B-rated flicks* that Hollywood used to stoke public paranoia and rack in millions.

Every few years she would read Nemesis again. Perhaps it was one of the figures in *Nemesis* that stuck in her memory – mass extinction events and their intensity:

It took her a good decade before she could admit she understood what a Fast Fourier Transform (FFT) was all about. The book said that a FFT of extinction data showed a mass extinction occurred on average very 26 million years.

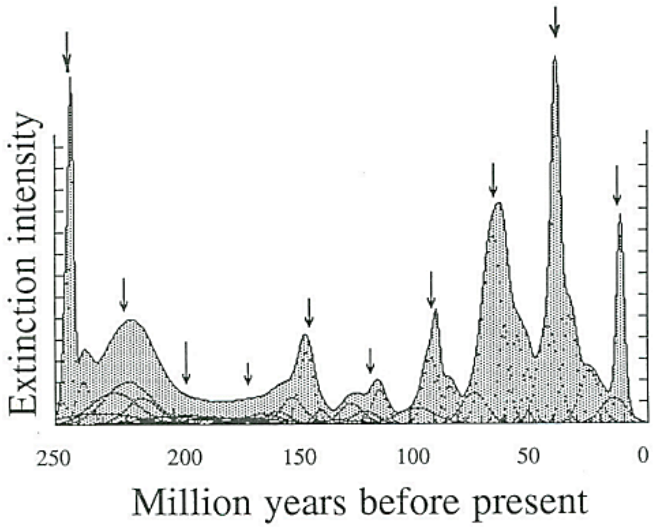


Fig. 16

XBL 8611-4774

When she was thirteen Sally wrote an essay for a science fiction contest and won first prize. It was titled “Oh my, where are all the Aliens?” Her essay was about the *Fermi Paradox*. In her essay she tried to reconcile that fact that thousands of exoplanets had been discovered including dozens of Earth like planets in habitable zones around G and K type stars, but there was little to no the evidence of intelligent alien civilizations anywhere in the SETI searches?

In her ‘*Where are all the Aliens*’ essay Sally updated the outmoded 1960’s Drake equation using contemporary exoplanetary data and concluded there could be millions of intelligent civilizations scattered in space and in time in the Milky Galaxy. However she also concluded that the window of contemporary time and the vastness of interstellar space made it unlikely intelligent alien civilizations would be in the position to contact us, let alone visit planet Earth. She concluded it was implausible that aliens had visited Earth.

Yet she kept a modest amount of hope in her heart and every few years would bring herself to watch Erich von Däniken’s 1970 film *Chariots of the Gods: Unexplained Mysteries from the Past* … to convince herself there were unanswered archeological and anthropological questions here on Earth that relates to the Fermi Paradox.

This, her first introduction to science, at age ten left a lasting impression on Sally. Now nearly six decades later, nearing her official and mandatory retirement at 65, Dr. Sally Aristo was the ‘*go-to*’ person at the Astrophysics Institute about objects that periodically fall out of the sky and struck the terrestrial planets, in particular Mars. Quietly she was convinced we were not alone in the Milky Way Galaxy. Quietly she collected evidence that we were not. Good fortune would smile on her.

The mass extinction crowd studying catastrophic collision events on Earth had sort of dominated the planetary collision subject for decades. They had all but picked that bone clean when it came to the Earth-Moon system. To walk her own path as a post grad, four decades earlier, at age twenty Sally had decided to look for collision phenomenon on the surface of planet Mars.

She soon discovered that Mars was at the same time easier and harder to study. Harder because of the great distance from earth, yet easier because Mars' surface erosion was much slower than that on the surface of the Earth. Mars has no plate tectonics driving change and was not dominated by water effects.

Mars' oceans had frozen and in the Northern hemisphere been covered over by dust. Mars' Southern highlands being made of hard rock, was a better record of meteor, asteroid and comet strikes than the Northern hemisphere. She was an expert on determining the age of surface impact features on Mars, right down to craters a few meters across. She had noted a 26 million year periodicity to impacts on Mars.

She had also noted a less obvious 400,000 year cycle and one of around 100,000 years, but most of her colleagues scoffed at her short term periodicity conclusions. The surface impact features that intrigued her the most were those found on the North and South Pole of Mars.

A few years into her Institute appointment she was sworn into secrecy and had been invited to *in situ* surveying work on the Moon trying to decipher an enigmatic feature that had been found directly on the South Pole of the Moon. When planetary exploration found similar enigmatic feature at the two poles of Mars she was offered all the resources see needed and was asked to sort this phenomenon out. That was three decades ago. It has been a frustrating effort.

The enigmatic features were *Tetrahedral* about two meters high made of an exotic material that was neither natural nor made on Earth. The *Tetrahedral* were made of some material that was harder than polycrystalline carbon yet could withstand the heat of atmospheric entry and impact. The edges of the *Tetrahedral* hadn’t even been dulled by the heat, the passage of time or by atmospheric erosion. Two grown men could lift the features, provided they did so carefully.

The first time one of the *Tetrahedral* had been found it was at the South Pole of the Moon. The edge of the *Tetrahedral* being one atomic thick, the astronaut who cavalierly tried to pick it up lost all the fingers on his right hand, and nearly his life as well when his space suit had depressurized. It had taken scientists three months to figure out just how to pick the objects up, for every time they tried the sharp edge would cut through the metal of the lifting apparatus like a hot knife though cold butter. Eventually they realized that you had to use a five sided pincer to secure all four sides and the bottom instantaneously before lifting.

After the first few *Tetrahedral* were found a concerted search began for other similar objects on the other planets and moons in the Solar System. Avi Loeb of Harvard was quick to describe the item as an extraterrestrial artifact. However, some scientists were equally quick to argue that it could equally have come from an ancient civilization here on Earth that had long ago ceased to exist. They would point to the ancient Greek astronomical calculator the *Antikythera Mechanism*, first discovery in 1901, as an example of the sophistication of the ancients.

For a few years after the *Tetrahedral* were first discovered there was a media frenzy, but like many enigmas, once the conspiracy and kooky theories had run their course the public lost interest and this '*First Find*' as it became known by the Search for Extraterrestrial Intelligence gang was soon forgotten by the general public.

Of course, one of the loudest of the conspiracy theories was that the whole thing was an elaborate plot for 'certain parties', like NASA, to get billions of dollars in US government funding. Led by an octogenarian Bart Sibrel, the man who was punched in the face by Buzz Aldrin in 2002 for calling Aldrin a coward, a thief and a liar and who had made films accusing NASA of staging the Apollo landings in a back lot at Hollywood … was once again acting out a *phantasmagorical*. A few weeks into the frenzy, in the middle of an online interview, Sibrel suddenly had a stroke and died on camera, which only stoked his *phantasmagorical* more … when his compatriots accused him of being poisoned to cover up the truth. How kooky could things get?

However this '*First Find*' was not forgotten by the more sober and serious scientific community. After three long decades of searching for *Tetrahedral* two had been discovered on Mars, one on each of the Poles of the Moon and one on Earth deep in the snow and ice above Antarctica. A search was underway for a *Tetrahedral* that is presumed to be somewhere near the Earth's North Pole but Sally felt it was a waste of time for the Artic was just a giant ocean without any continent at the North Pole.

Sally had one of the five *Tetrahedral* in a specially designed and high security lab at her Institute. She got the first one found on Mars because she was the astrophysicist *in situ* who had found it and had claimed "*finders … keepers …"* To protect her find she had had to mislead and obfuscate Dr. Avi Loeb who confronted her at a conference at Harvard. How Dr. Loeb had found out about her *Tetrahedral* she would never find out, because she knew not to ask. To ask was to invite further inquiry.

Twice armed intruders have tried to steel it away from her and once she had even been kidnapped for a few hours, but she was prepared to die rather than give it up. So they let he go. Who these thugs were no one could figure out. Rumor had it they were funded by an aged, illusive and eccentric billionaire who felt he deserved to have anything he wanted ... the billionaire whose rockets kept on blowing up. He had even offered a Billion dollars for anyone who had one for sale.

It's amazing the *Tetrahedral* secret had been kept a classified and out of the public eye for so many decades. But it was understood by those in the know that this is the way things had to be handled until someone could figure out what they were all about, where they had come from, and who had built them. Otherwise there would be widespread panic and paranoia.

She had found her *Tetrahedral* in a 3 meter diameter crater with an age on the order of 101,250 years. The next one would on the South Pole of Mars was estimated to be 202,500 years old. She did not believe in coincidences and sorted it out that a periodicity leading to 405,000 years may be at play here. And everyone in astrogeology knows what that means! It means the Milancovitch cycles.

There was a certain mystique about her because amongst some astrophysics groupies her name had been rumored associated with the *Tetrahedral*, so she was a popular figure at Astrophysics Conferences. Her favorite T-shirt and one she periodically wore at astrophysics gatherings that had the words *Cosmic Collisions do Matter* brazenly written across the front and back of her shirt. It was a one-of T-shirt that she had designed just for herself.

It was common knowledge that a giant cosmic collision had created the Moon. There had also been a cosmic collision on Mars about the same time, some three billion years ago. The front of her T-shirt depicted Mars before the collision and the back showed the after effect.

She drew the inspiration for her T-shirt from a paper she had read three decades ago. The reason why the Northern and Southern hemispheres of Mars were so very different had been first fully explained by a paper titled *Comments on the Topological Anomalies on Mars*, published at a scholarly journal.

She had been so impressed with the paper when she had first read it that she had had it printed and framed on her wall:

*****

Comments on Topological Anomalies on Mars

A detailed survey of the surface of Mars delineates a clear distinction between the lower elevation and smoother Northern Hemisphere, compared to the rockier highlands found in the Southern Hemisphere (Refer to Fig. 1: A Topology of Mars).[1]

At an average height of 2,000 meters above that of the lower, Northern Hemisphere, the volume of material making up the Southern highlands is estimated to be on the order of 1.44 x 10^{17} m^3. This could be represented by a sphere or bolide of approximately 650 km in diameter. [2]

Imagine such bolide impacting the surface of Mars, melting and flowing with a Reynold's number of perhaps 3,500, radially outwards from the point of impact. This pyroclastic material would flow out radially as a laminar sheet until such a distance that turbulence set in. [3]

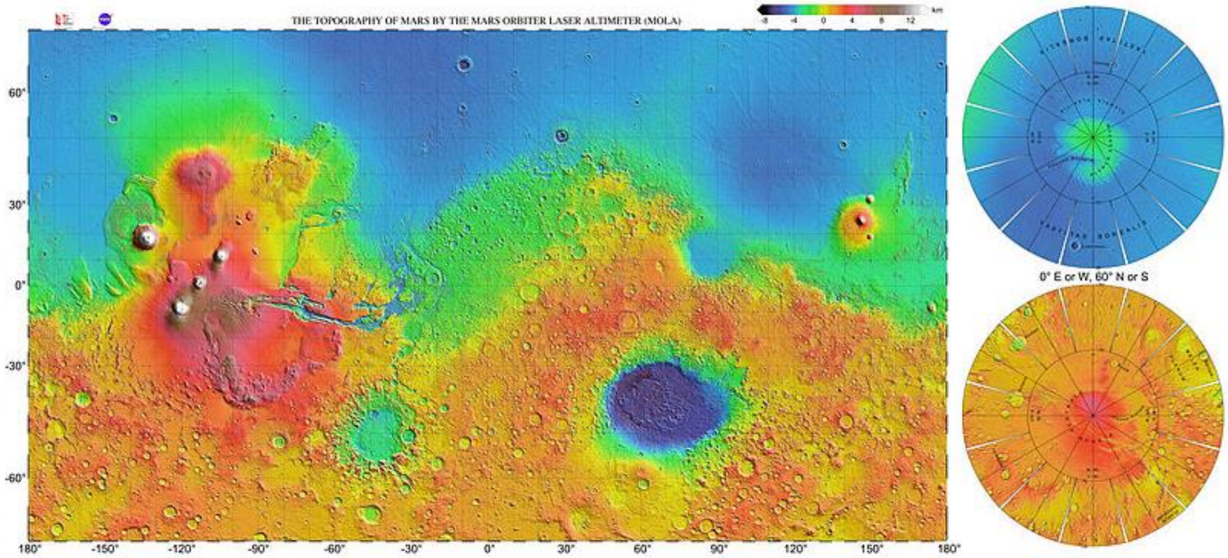


Fig. 1: A Topology of Mars (courtesy of NASA)

Is it possible to estimate the distance of turbulence onset given the size of the impacting bolide? Let us assume a ninety degree change from impact direction to flow direction. When most fluids take a ninety degree turn in a constrained volume there is a *rule of thumb* that turbulence will set in at between 3 to 4 times a characteristic distance, set by the flow.

An example of this type of onset of turbulent flow is shown in Fig. 2. In Fig. 2 water is impacting the surface of the back of a circular ceramic plate. The change in flow direction is ninety degrees. You can see a laminar region near the spigot and a turbulent circular region some distance from where the flow impacts the surface. The ratio of the outer diameter (the turbulence edge) compared to the inner diameter of the flow feature in Fig. 2 is between 3 to 4 in this example.

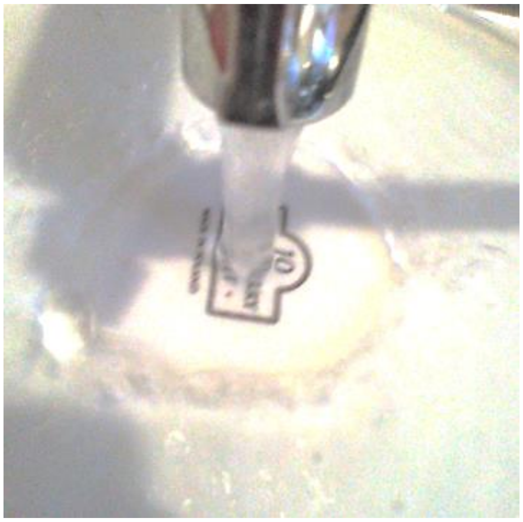


Fig. 2: The Onset of Turbulence

In the case of the impacting bolide this characteristic distance is perhaps the diameter of the bolide. Is there an impact structure that is perhaps 3 to 4 times such a bolide diameter of 650 km on the surface of Mars? Indeed there is. It is the *Hellas Basin* in the Southern hemisphere of the planet.[4] The *Hellas Basin* has a diameter of 2,240 km and is a prominent feature in the Mars highlands (refer to Fig. 3: The Hellas Basin).

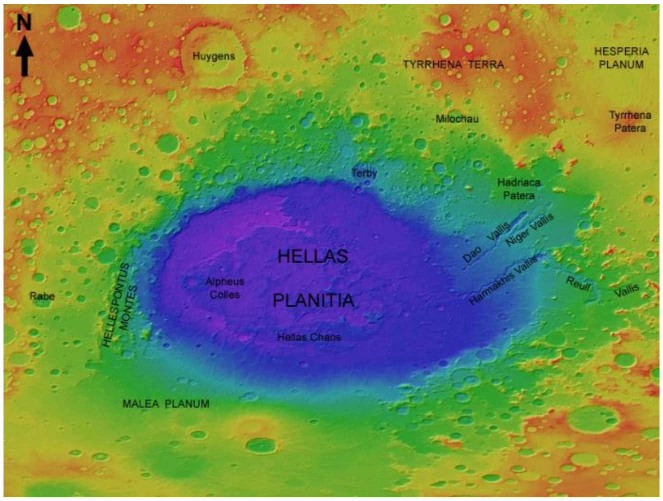


Fig. 3: The Hellas Basin on Mars (Courtesy of PSI)

The impact that created the *Hellas Basin* appears to have been at an angle, hence the elongation of the feature. Comparing Fig. 3 to Fig. 1, there is a difference in the color calibration. The colorized blue and green regions in Fig. 3 correlate to the colorized blue region in Fig. 1.

In Fig.4 there is an overlay of the entire feature to the central height of *Hellas Basin* in greater detail (refer to Fig. 4: Hellas Basin in detail).[5] A height scale in meters is provided.

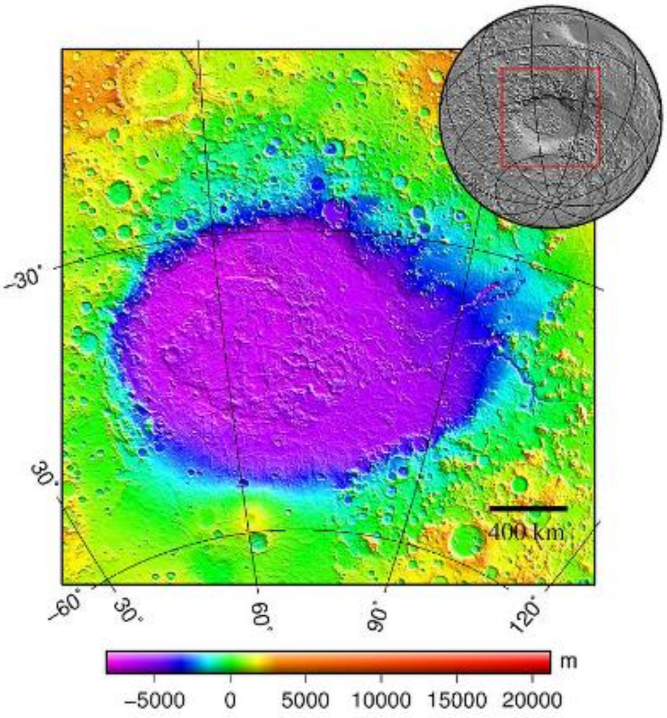


Fig. 4: Hellas Basin in detail (Courtesy of NASA)

Let us try to delineate the central portion of the feature in the *Hellas Basin,* to the distance where turbulence sets in. Two circles are drawn in Fig. 5, the outer black circle, which delineates the turbulence edge, and is on the order of three times the diameter of the inner black circle, which delineates the flow region. By inspection, we still find a ratio between 3 and 4.

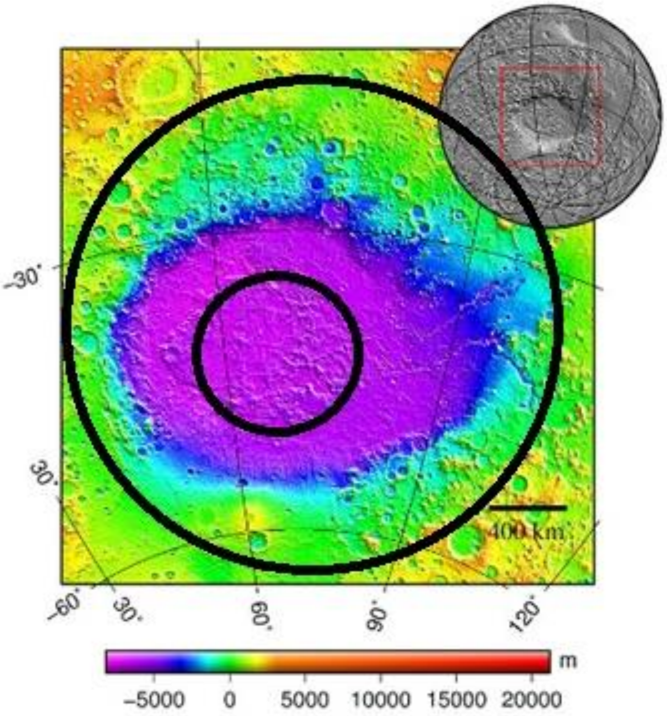


Fig. 5: Feature ratio in Hellas Basin

These two regions correlates well with the hypothesis that the Mars highlands are the remnants of a 650 km diameter bolide that created the *Hellas Basin*.

The smoother Northern Hemisphere begs the question was Mars before such an impact in fact a water world, or planet whose surface was entirely covered in water. There are planetary scientists who wonder the same thing about the Earth, that the Earth may have been a water world, prior to the bolide that impacted the Earth and created the Moon. It appears that impact on the Earth might have pushed the bottom of the ocean up to above sea level which because of the size of the Earth and the presence of a magnetosphere has provided a dynamic *geological* history.

In contrast, the planet Mars has not been *Marsologically* active over many hundreds of millions of years. There is the open question as to whether Mar once had a magnetosphere, as well as a thicker atmosphere. Without a magnetosphere a planet cannot not protect its atmosphere from erosion due to the solar wind.

We hypothesize that future assays made in the lowlands of Mars may show the Northern Hemisphere features to be older than those of the southern highlands. We hypothesize that if Mars in the distant past had a magnetosphere such indications might be found frozen within some features of the Northern lowlands. There may also be indications of the past atmosphere on Mars.

If Mars did indeed have a magnetosphere in the distant past, the impact of a giant bolide may have sent a shock wave through the planet that might have disrupted the spin of the core of Mars. Perhaps this can be shown in seismic studies of Mars. This might also be the cause of the *Tharsis Bulge* on Mars.

In the case of the inside of the Earth, it has been only recent that geophysicist have found remnants of such a shock wave that dates back to when the bolide that created the Moon impacted the Earth. This shock wave might be the cause to the physical and magnetic asymmetry in the Earth's Core. [6] This asymmetry in the Earth's core may be the cause of the dynamic and random periodic flipping of the Earth's magnetic poles.

It is also possible that cracks or rifts made to the surface of Mars after the bolide's impact may have allowed surface water to flow deep enough into the planet to quench the internal heat of Mars. The now superheated steam might then have vented to the surface via the prominent volcanoes that are found nearly opposite *Hellas Basin* on the surface of Mars. The venting of large quantities of steam and hot gases would have greatly disrupted the atmosphere of early Mars.

There may be subsurface cracks, now covered over my dust and debris, perhaps somewhere between the *Hellas Basin* and the prominent volcanos on Mars. Why three volcanoes are in a straight line may relate back to the cracking of the sub surface of Mars by the impact of the 650 km wide bolide (refer to Fig. 6: The Volcanos and Tharsis Bulge on Mars).[7]

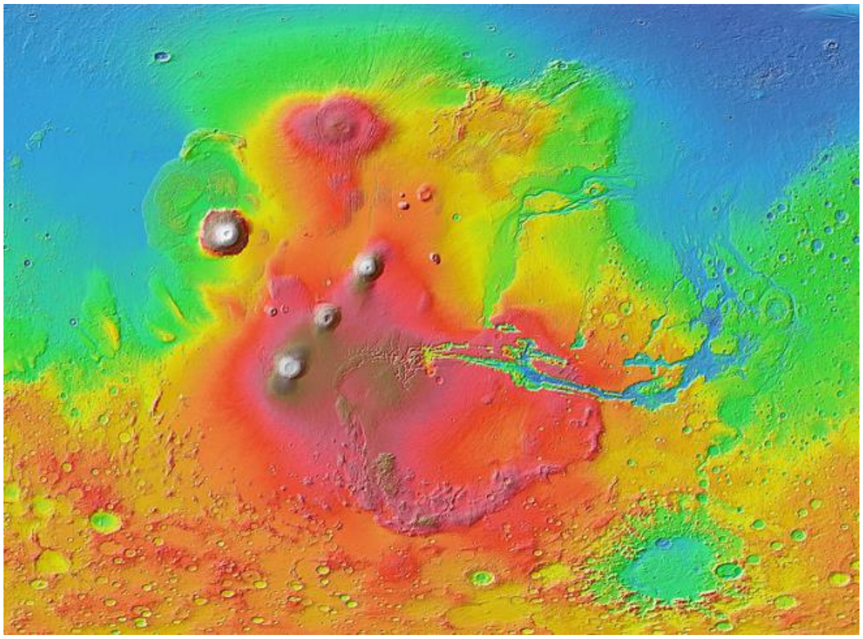


Fig. 6: The Volcanos and Tharsis Bulge on Mars

Why the three volcanos are in a line on Mars has never been adequately explained. It is worth noting the distance between the two outer volcanos in the line is comparable to the diameter of the core of Mars. It is also worth noting that the distance of the line is comparable to the perpendicular distance to Mons Olympus. This may mean that all four features are tied to a common phenomenon. You may note the volcanos are 180 degrees opposite the *Hellas Bulge* on Mars.

Perhaps the common phenomenon is the shock wave from the impact of a 650 km bolide and how it interacted with the core of Mars? The volcanoes may come from the shock wave diffracting around the posterior side of the core, while the *Tharsis Bulge* may come from the shock wave interacting with the anterior side of the core (refer to Fig. 7: A Common Phenomenon?).

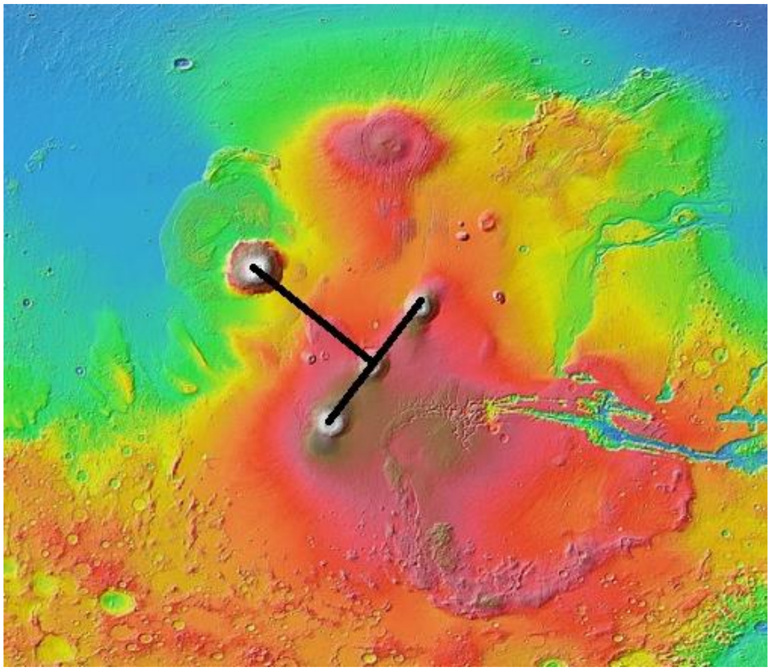


Fig. 7: A Common Phenomenon?

It should be possible to undertake isotopic analysis of signature elements of samples from the Northern lowlands and the Southern highlands to determine whether they are of a common origin. Such assay isotopes might include Zn, Ni, Mg, Ti and Fe. If the highlands are indeed the result of the impact of a 650 km diameter bolide then there may perhaps be isotopic indicators to this possibility. An assay should also be done on the materials at the volcanos and the *Tharsis Bulge*.

Conclusion

In this short paper it is proposed that a bolide 650 km in diameter created the highlands in the Southern hemisphere resulting in significant topological anomalies or features on Mars. This impact would have altered a number of the early physical features of the planet and may have disrupted any magnetosphere and atmosphere the planet may have had before the impact.

References:

1. Refer to: https://en.wikipedia.org/wiki/File:Mars_topography_(MOLA_dataset)_with_poles_HiRes.jpg

2. The surface area of Mars is 1.44 x 10 ^{14} m^2. The highlands constitute around 50 % the area of the surface of Mars. The mean height of the highlands is 2000 m. The volume of the material in the highlands is estimated to be 1.44 x 10 ^{17} m^3. A sphere with this volume would have a radius of 325 km. The diameter of such a spherical bolide is therefore 650 km.

3. A subsequent paper will be written about this turbulence related phenomenon.

4. Refer to: https://www.psi.edu/epo/explorecraters/hellastour.htm

5. Refer to: https://en.wikipedia.org/wiki/Hellas_Planitia#/media/File:Hellas_basin_topo.jpg

6. Refer to: https://news.berkeley.edu/2021/06/03/is-earths-core-lopsided-strange-goings-on-in-our-planets-interior/

7. Refer to: https://en.wikipedia.org/wiki/Volcanism_on_Mars#/media/File:Tharsis_-_Valles_Marineris_MOLA_shaded_colorized_zoom_32.jpg

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The assay of the materials that made up the Southern highlands correlated well with materials from the very edge of the Solar System. She had asked a friend to speculate about the bolide that caused the *Hellas Basin* and he was able to correlate the material back to the Oort Cloud. He had tried to explain to her that it had something to do with isotopic ratios of Oxygen-16 to Oxygen-18, as well as several trace metals. Not being a nuclear physicist, she took him at his word. His explanation reminded her of Dr. Luiz Alvarez's Iridium explanation for the extinction of the dinosaurs.

When she drew him into her trust a few weeks ago and got him to sign a non-disclosure agreement, he had measured the same isotopic ratios in oxygen ratios making up the molecules on the sub-surface material of the lunar *Tetrahedral*. This could mean the *Tetrahedral* came from way out there in the Oort Cloud. Now she had a *New Nemesis* on her plate.

Having discovered this, all her colleague wanted to do was to share his find with the rest of the world at this Astrophysics Conference. *Damned Academic*! She thought. She had begged him off, reminded him he was sworn to secrecy, and when he didn't sway she had to flag him.

The following morning the FBI took him into custody just as he was leaving to fly to the conference. Sally hated herself for having to do this, but it was for the greater good, she convinced herself. The FBI arranged a phone call between the two of them hoping she could dissuade him   Instead he threw harsher words than geek her way when she went to visit him in custody.

The newspaper that afternoon ran a story of an unnamed nuclear physicist who has been arrested by the Federal Bureau of Investigation and is in custody for violating a classification oath. That little drama occurred last night. Today the public was the worst for not knowing. She found solace is being to say to him … I told you so!

Today Dr. Sally Aristo would have preferred to be safely ensconced in her office back at the Institute but … the only reason she was at the annual American Society for Astrophysics conference was to listen to a young man present a paper titled *A String of Pearls in the Oort Cloud*. It was to be his first presentation at a professional conference.

Dr. Aristo knew who he was and had been watching and admiring him from afar for several years. She had even helped him out by keeping the backdoor to her Institute's supercomputer open for him so that he could have access to the data he needed to do his research.

In the back of Dr. Aristo’s mind she sensed this strange phenomenon, his *string of pearls*, had something to do with her enigmatic *Tetrahedral*. Lucky for her this conference was so back water that no media group had thought it worth sending a journalist.

That meant Sally would have an unfettered chance to see what the young astrophysicist had to say and perhaps have some say in how his story was spun to the media … before Avi Loeb grabbed hold of it … or the Conspiracy Theorists … or the *Little Green Men* kooks.

Chapter 3 – Time for a Closer Look

It was wonderful that they let him present his results. Nonetheless, his was the last session of the last day of the International Astrophysics Conference. Most delegates had already drifted to the dining room, their beers, spritzers and cocktails at hand and a look at the buffet table.

They had originally given him thirty minutes but now the facilitator, looking at his watch, had decided to give him only fifteen minutes. They took five of his precious minutes to find him a wooden box to stand on and adjust the microphone to its lowest angle. That, at least, gave him time to par down his talk to the bare essentials.

Then the facilitator introduced him. Thomas walked to the podium, stepped up on the box, peered past the microphone and noticed only a half dozen people in the six dozen chairs in the room. At least they were all in the front row he thought. The women right in front of him was recording his talk on her cellphone.

The facilitator announced his talk *A String of Pearls in the Oort Cloud*, and he began. He was shy and spoke softly.

“Speak louder” the woman in the front row asked him.

Just two minutes into his talk a man in the audience got up and hurried out of the room. Thomas choked back a sigh. Now there were only five. Then, to his great surprise, a few seconds later the doors at the back of the room flew open and a dozen people drifted in, some sipping at their beers, spritzers and cocktails. This started a steady trickle of more people coming to listen to him. By the five minute mark of his talk the room was half full.

This gave him a jolt of energy and he started to speak louder and more emphatically. By minute eight the chairs were all filled; by minute ten the room was packed with standing room only.

After his allotted time he stopped …

The facilitator waved him on to continue and so he did. So he meticulously presented his algorithm and a description of HGIPSY. He slipped in a few histograms he had left in reserve. He thanked the Institute for allowing him access to their Oort Cloud data. Then he made a public admission that he had used a back door into their data base. The woman in the front row smiled then nodded as Thomas said this. He smiled back at her. Aha, Thomas thought … he had found his champion!

After an additional thirty minutes he had come to the end of his prepared presentation. But he continued to improvise for five minutes.

Then he suddenly said “that is the end of my presentation.”

Then the questions began.

“How big do you think the central feature is?”

Thomas replied meekly, “it is at least as big as Jupiter ,,,”

“That is open ended. What is it …one time, two times … many times Jupiter’s size?”

Thomas shrugged his shoulder. “Perhaps many times … we need to gather more datat to know for sure.”

It was the woman in the front seat that answered this question. She turned around and said “I estimate it is at least three or perhaps four times the radius of Jupiter.”

Someone in the audience asked her how she knew this and so she asked Thomas to go back to one of his histograms, histogram six. Thomas smiled. He knew exactly what she was about to say. He had seen it as well, but he had wanted to study the data further before making any assumptions. She, on the other hand, had already established her reputation and so had much more courage in the public sense.

She spent several minutes walking the crowd through a calculation she had done in her head while she had been listening to Thomas' lecture. She easily convinced the room.

Then someone in the back of the room piped up "that means the object has a mass of perhaps 35 Jupiter masses."

There was a collective gasp in the room and then an impromptu astrophysics seminar began that the facilitator let flow freely. Before he knew it an hour had passed but still the astrophysicists did not drift away to their chicken dinners.

Thomas ventured forth with "it has an orbital period of 101, 225 years." The room went deathly silent …

The facilitator took this silence at heart and called the session to an end. The applause was deafening. The head of the conference insisted he had his picture taken with the young speaker. Many of the delegates milled about and were speaking excitedly of his presentation. They wanted to introduce themselves and shake his hand. His hand hurt from all the attention.

At ten years old he was by far the youngest lecturer at this or at any Astrophysics Conference for that matter. Then like a school of fish the astrophysicists all swam out to dinner leaving him to gather his notes and stuff them into his knapsack.

When he looked up he saw the only person remaining was the woman in the front row who had been filming him on her cell phone. She smiled and asked “what do you think it is?” with an emphasis on the word *you*.

The young man answered, “It defies natural phenomenon.”

“Indeed it does! … but you didn’t answer my question.”

ThomasKepler paused for a moment then said “*Hypothese Non Fingo*,” repeating the famous phrase once immortalized by Isaac Newton as a counter to the absurdities of Rene Descartes – “I do not speculate …”

“I won’t hold it against you … if you speculate.” She looked around the room and then leaned forward and in nearly a whisper continued “but we are alone … will you speculate just for a moment? It will be between you and I”

He smiled. “You know who I am. Who are you?” He had a guess but he wanted his guess confirmed. She introduced herself, Dr. Sally Aristo, head of the Astrophysics Institute. He grinned. When she had said no officially to letting him use their Institute’s supercomputer directly, she had nonetheless been the person to let him unofficially use a back door to get access to their Oort Cloud data.

She must have been reading his mind for she said, “the second time you intruded into our supercomputer my IT people insisted I should shut the door … but I said no … I let you use the data because I was curious to see what you were doing and what you would make of the data.”

He smiled proudly. “Well now you know …”

“And now so does half of the world. You do know Avi Loeb was here in the audience listening to your talk.”

He nodded.

“He’s probably waiting for you outside this conference room.”

“I doubt it … I notice his martini glass was empty …”

“You are very observant. I suspect he will be back. What will you say to him?”

“*Hypothese Non Fingo.”*

“For a young man you have a good sense of what is right and what is wrong,” she said.

He stepped down from the podium and she walked over to meet him. “Let me throw my cards face up … I think it is not from this Earth. I would not be surprised if it is extraterrestrial …”

He stayed silent. If he said this they would say it was the product of the vivid imagination of a young boy.

“Let’s duck out the side door and go chat in my office. I would like to offer you a position at my Institute. ”

“What about dinner?”

“I can order in …”

“Are you kidnapping me?”

Her face when red spontaneously. “Noooooo … I just think we need to talk.”

“Can I phone my mom …”

“Sure, better yet let’s swing by your home and pick her up.”

“I think we need to take a closer look at the *string of pearls* don’t we.”

She nodded emphatically in agreement.

Chapter 4 – It Came From Outer Space

The Harvard astrophysics professor stood sipping his *Martina* and chatting with a colleague within eyeshot of the door. For the umpteenth time he was asked curiously why he called his called his drink a *Martina* – and he would quip the Wayne & Shuster Latin joke “if I wanted two I would ask for two …” Martini being the plural of Martina.

Avi knew eleven spoken languages if you included higher mathematics as a language. If you added the computer languages he was fluent in, this would bring the total to over twenty. His was a very busy mind!

Dr. Avi Loeb waited for them to leave the lecture room for a good ten minutes then he poked his head in only to discover they had dashed out the side door. Short of asking the two of them directly, their disappearance confirmed what he had concluded in listening to the lecture the *String of Pearls* must be of extraterrestrial origin! He also knew her name was confidentially linked to the mysterious *Tetrahedral*.

Avi did not believe in coincidences. In his measure of things … two plus two equals four … at least nine times out of ten.

Dr. Loeb took his cellphone out of his jacket pocket and spoke a name into the AI. In a split second a familiar voice came on over the cellphone. “Hello Bill, its Avi.”

“What’s up?” The voice sounded tired.

“I am still here at the Astrophysics Conference. Are you still kicking about?

“No, I am in my office writing the story we had sorted out earlier today.”

“Hold the presses ... have I got a story for you.”

“Avi, I wish you would stop doing this to me. It is wrecking our professional relationship. I have already cleared the story we talked about over lunch with my boss. They need it pronto for the evening news.”

“Then let them have *that* story and tell your boss you have something better for the eleven o’clock news.”

“Listen Avi … if I promise to call you back in an hour will you let things sit until then? I need to get *that* story onto the wire ...”

Avi looked at his watch. “Sure Bill, if I haven’t hear back from you by 7:12 I will call you.”

“Dr. Loeb … you’re like a cat on a hot tin roof …”

“Come again?”

“You jump about a great deal. It’s hard for us mere mortals to keep up with you!”

“I have always been like that. This is how I get things done!” There was a pause. Avi hoped his journalist friend would talk with him about the new science news lead he had … but it would not be. He would have to wait.

“I promise I will get back to you … before 7:14 … time marches on …” His science journalist friend was pushing back. “till later Avi,” and then hung up.

Within and without the astrophysics community, Dr. Avi Loeb was not known for his patience. Having thought it over for another fifteen minutes he was now certain that the *string of pearls* was tied to the *Tetrahedral*, and they came from Outer Space.

When he entered the dinner salon he was waved over to a table near the front. He acknowledged the wave then made for the bar. At least Avi had dinner to distract him, but first to quench his thirst he needed a Martini …

Chapter 5 – Maybe it was the Illogic of it All!

The meeting between the three of them had been pleasant and far reaching. She had proposed to his mother that they would take him on as a special consultant and also make arrangements for him to do his university work under their auspices.

Half way through their meeting her secretary paged the Director of the Astrophysics Institute on her desktop intercom. “The caller you were expecting has telephoned.”

“I need to take this …” she said then picked up the telephone. “Good afternoon Director … yes he is here.” She pressed a button then set the telephone back into its cradle. “We are on intercom.”

The voice on the intercom spoke. “This is the Director of NASA. Hello.”

The little boy nearly jumped clear out of his chair. “Calm down …” his mother whispered, placing a hand on his shoulder. “Say hello …”

“Hello ...” Thomas responded shyly.

“Hello … I watched your presentation online and concur with the Astrophysics Institute’s Director. We need to take a closer look at your *string of pearls* …

There was a short pause and then the Institute Director asked “How are we going to do this?”

“I have ordered the James Webb Space Telescope be taken offline for unplanned maintenance, and while it is on this mode we will re-task the space telescope to do a thorough infrared survey of this mysterious phenomenon. I wish we had Hubble still operating to get some visible data. I don’t want to ask any ground-based telescopes to take a look … we would not be able to do a survey with a ground-based system without the results appearing on the front page of the New York Times or the Washington Post. At the moment we should just use the James Webb …”

“I think this is an excellent suggestion director,” Dr. Aristo concurred. “When do you think we can begin the survey?”

“My key people say it will take perhaps four days to realign the platform and do the preliminary focusing. We will start five days from today. Can you coordinate things at your end?”

“Of course … we just need to sign off what we have already discussed.”

“Perfect …” even the NASA Director sounded excited. “Did you catch the evening news?

She looked at the clock on her office wall. The old brass clock was once in the main dome of the Mt. Wilson observatory. It was quarter past seven. “No Director, we have been in our meeting.”

“Someone broke the *string of pearls* story!”

“On no! Was it Avi?”

“I just got off the phone with him and he pleaded ignorance. I could sense in his voice that he felt frustrated. I think he is upset that someone beat him to this punch.”

“Poor Avi … he likes to be at the leading edge of any extraterrestrial stories.”

The voice on the intercom continued, “The press with want to talk with your protégé.”

“I guess they will …” The Institute Director sounded annoyed. “Any suggestions?

“Maybe chat with Avi and tell him enough to carry the banner …”

“You do know what he might want in return.” There was a mysterious tone to Dr. Aristo’s voice.

“I can just guess … but just don’t let him have it.” The NASA Director was firm. “You know the rules!”

“I don’t know if I can. Dr. Loeb can be quite persuasive.” She responded.

“You mean persistent.”

Dr. Aristo paused, looked across at Thomas and motioned to the boy to say something

The little boy felt like the elephant in the room. He spoke up. “NASA Director …”

“Yes, young man.”

“Do you think it is *Extraterrestrial*?” He was so nervous he stumbled with the word *Extraterrestrial*

There was a pause … “Please don’t quote me but the *string of pearls* do not appear to be natural, do they? And we humans haven’t ventured that far out into space have we!”

The little boy spoke with a tremulous and excited voice. “I really don’t know if they are extraterrestrial. They just don’t appear to be a natural phenomenon.”

The NASA Director laughed then said “*hypothese non fingo*.”

The little boy lowered his head and blushed. “Exactly.”

The voice on the intercom sang out. “A good scientists is always cautious and conscientious.”

The room went silent.

“Son … we owe you a great debt for the work you have done, and the discovery you have made. I will make you a promise that you will have a front row seat while we try to sort out what this phenomenon is using the James Webb Space Telescope.”

Thomas sat up in his seat with a jolt. “Thank you Director.”

“You are welcome. I will make arrangement for the Astrophysics Institute to have a direct feed to and unfettered access to both the raw data … as well as any of the processed data.”

Thomas leaned on the front of his seat clasping his hands together in glee.

“We will have to tread carefully. Congress still hasn’t forgiven us about the Life on Mars kerfuffle ...”

Thomas said “kerfuffle …” just loud enough for the NASA Director to hear him say something.

“What was that Thomas?” The voice on the telephone asked.

“What is a kerfuffle?” Thomas asked. “It’s a word I have never heard before.”

“It’s a British term. A Kerfuffle is a commotion that is a result of a disagreement. One of the Congresswomen used the word during the Life on Mars hearings and this is how the whole Viking matter has been remembered. ”

“Director,” Dr. Aristo broke in, “This happened before Thomas’ time. Perhaps you need to explain what the Kerfuffle is about.”

“Sure … NASA having found signs of life using Viking in 1976, a few years ago Congress convened special hearings because they wondered why, the prevailing view within NASA was that there was no definitive signs of life on Mars.”

“I thought they found no sign of life on Mars when Viking landed.” Thomas was confused.

“On the Viking Landers there were two experiments looking for life, one involving a gas chromatograph to look for long chain organic molecules and another involving a wet experiment using a growth medium. The gas chromatograph yielded a null result while the experiment that Dr. Levin and his wet experimental group put together yielded a series of positive result. In hindsight, we know today that the gas chromatograph did not have the sensitivity to detect long chain organic molecules. Most likely the UV rays from the sun cut up any long chain organic molecules exposed on the surface of Mars.”

“I guess I should go and read what Dr. Levin and his scientific colleagues have to say.” Thomas spoke slowly as he said this.

“Ask Dr. Aristo to help you with this, she is familiar with the science … just don’t tell anyone I have put you up to this. I have decided to stay neutral in the matter because the emotions still run high on this at NASA.”

“I will lend Thomas my file with the literature,” Dr. Aristo said.

“I have to go now. We have a James Webb planning meeting in a few minutes. Dr. Aristo I will call you again tomorrow around this same time.”

She leaned forward and pulled the telephone off its intercom cradle. “We are private,” she said. She nodded her head and said “good idea. Thanks, talk with you tomorrow.” She set down the telephone and smiled. “NASA will be a cosignatory in our consultation agreement. If you need any help managing the press … NASA can provide you with a publicist.”

His mother spoke up. “That is a good idea. I want the press to leave my son alone so he can focus on his science.” The little boy turned his head and nodded emphatically at his mother.

The Institute Director smiled and got up and opened her office door. Immediately in wheeled her secretary with a trolley with dinner on it. “You must be very hungry. After all it has been long and tiring afternoon for you,” the director said. The secretary smiled at Thomas as she walked past him and he smiled back at her. Then she left the room and closed the door.

All three got up and walked over to a round table at the far side of the room. The secretary had set out the three plates, the silverware (which was real silver) and the four offerings of salad, main course, side dish and desert. Then the director said "… oh I wasn't thinking."

"What's wrong? His mother said.

"I wasn't thinking! This is from the conference. It is roast chicken in white wine sauce with roasted potatoes, vegetables and mushrooms. Is your son ok with white wine?""

"Maybe he'll just have some salad?" his mother said.

He protested. "Oh mom … I am not a little boy anymore."

"You aren't, but the age of consent in this state in 18 and you still have a way to go before you are allowed to drink."

"Mom, the cooking will have evaporated away the alcohol …"

His mother turned to the Institute Director and asked, "Is this true?"

She shrugged her shoulders. “I am neither a chef nor a chemist.”

The little boy quipped “cooking is just applied chemistry …”

The Director is response joked “kitchen chemistry?”

The little boy nodded and his mother relented. “Ok you can try the chicken but don’t blame anyone but yourself is you have a hang-over tomorrow morning.”

“Mom, everyone knows that all you need to do to avoid a hang-over is to drink a lot of water …”’ and with those words dived right into his chicken dinner.

His mother smiled proudly at her son and soon all three were enjoying their late and somewhat cold dinner. They talked a bit about different things. The Director asked his mother what he was like as a young boy and his mother asked the Director whether she had any children. Sadly, she shook her head. “I have dedicated my life to science …” but her intonation was not all that convincing.

Then he cell phone started to buzz and she walked to her desk opened the drawer and drew it out. “I thought I had turned it off.” She turned it off and put it back into her desk and returned to the table. Just as she was about to sit, the cell phone rang again. Perplexed she returned to her desk, opened the drawer and took out the phone. She scrolled down and read who was calling her. “Persistent” she said.

“Dr. Loeb,” he asked and she nodded.

“I guess I should take this call … Avi how did you do that? Friends in low places … ya a ya I have heard this from you before …ahum … ahum … I can neither confirm nor deny this. Avi you know not to ask me this.”

She listened for a good twenty seconds smiling broadly. Then she asked “what do you think? LGM … it’s always little green men with you. Why can’t it be BPW … big purple women?” She giggled.

“What?” They took the James Webb offline? Where did you hear this?” Sally had taken acting while at university. She had been good on the stage and so she knew how to lead a person on without telling a half-truth.

“Tell me Avi, did you seed the news story about the *string of pearls* and LGM.” Instantly she moved the cellphone away from her ear and grimaced. “Take it easy Avi … I believe you!”

“ahum … ahum … no Dr. Loeb, have you been watching reruns of the X-files? No one is conspiring to keep the truth from the American public.”

She listened for a few seconds and then interrupted him. “Listen I am just having dinner. Why don’t you drop by tomorrow and I will introduced you to a new member of our staff.” She smiled. “You want to meet him in person do you? Can I ask a favor? Is it too late to enroll him in the next term at Harvard?”

He smiled broadly letting white wine sauce drip off his chin.

“How about two tomorrow and don’t forget to bring his enrolment papers, signed by the Harvard Chancellor ...”

He didn’t know if it was his excitement or the wine sauce but he suddenly felt dizzy!

After she had finished her conversation with Dr. Loeb the three of them sat and ate their meal. Dr. Aristo told Thomas more of the background about the Life on Mars Kerfuffle. He was particularly amused about the face on Mars conspiracy theory.

For some reasons Thomas took a perverse interest in conspiracy theories involving aliens or extraterrestrials. Maybe it was the illogic of it all! After all he had grown up watching reruns of the X-Files. His favorite X-Files episode was *Soft Light,* about a particle physics experiment gone wrong that makes the shadow of a man a black hole able to suck up the unsuspecting.

Like the Director Thomas also very much enjoyed vintage Sci Fi *It came from Outer Space* films like *The Day the Earth Stood Still, War of the Worlds, Chariots of the Gods, The Hitchhikers Guide to the Galaxy, Final Fantasy, Fifth Element* and the entire sub-genre of Science Fiction films about alien civilizations and alien visitations.

Like Sally he preferred the Science Fiction films that drew from Hard Science and not from fantasy. He was proud to say he had not read any of the Harry Pothead books or saw any of the Harry Pothead films. To Thomas this was brain fungus. For him *Star Trek* and *Star Wars* was a hit or miss cornucopia of Hollywood slock.

A few years ago, when he was only twelve, he had studied both the Drake Equation and the *Fermi Paradox* in great detail and had reached the conclusion that intelligent life must exist elsewhere in the Universe, but thought it unlikely they would be close enough to pay Earth a visit, or that they would even want to visit Earth given humanity's many shortcomings. He had even read Sally Aristo's prize winner essay "*Oh my where are all the Aliens?*" online but he had long forgotten that she had written it when they first met.

At thirteen Thomas speculated as to what type of civilization would be space faring and he realized that given the type and quantity of material and the type of machinery needed for interstellar travel, that a cooperative society would be the most likely to be space faring. It seemed obvious to him that it boiled down to a choice between *Nash Equilibrium* or *Zero-Sum*. A *Zero-Sum* or winner takes all competitive civilization would be too busy fighting among itself to look to interstellar space as a grand and unifying undertaking, while a cooperative civilization would inevitably become space faring and after tiring out with their own planetary system would want to venture forth and visit other planetary systems.

Even at a young age, being pragmatic, Thomas did not see humanity becoming an interstellar space faring civilization any time in the near future. Not at least until humanity stopped being so *Zero-Sum*. On a scale of one to five, what he saw today on planet Earth was perhaps a four, while a civilization able to travel interstellar distances would be perhaps a one and governed by a better of self, of compassion and of united purpose.

Strangely all this thought about aliens and extraterrestrials left him in a somewhat schizophrenic state … leaving him skeptical as a scientist but also open minded as an adventurer. He was the first to admit that ultimately, this dichotomy did not bother him.

Thomas knew that Galileo was a Pythagorean at heart believed that everything could be characterized in terms of mathematics.

Thomas knew that Johannes Kepler had had his belief in the Harmony of the Heavens, the Music of the Spheres, and that this kept him curious for all his adult life.

Thomas knew that Isaac Newton's had a secret interest in numerology and this this foible did not affect Newton's scientific thought in any way.

Thomas had heard that even Albert Einstein had his distraction … a thing for beautiful women and was a *bonne vivant*. Einstein had had numerous affairs and even fathered illegitimate children.

Moments before Thomas had noticed the kind smile Dr. Aristo's secretary had given him when she delivered their dinner trolley. She had noticed him blush in return …Thomas did not mind all of this for he knew that his present circumstances were about to make life so much more interesting. Thomas was an existentialist at heart though he didn't know this or had even studied existentialism. Since he was old enough to count, surrounded by children who were then only interested in play, Thomas knew he would have to create his own reality.

As he ate his dinner Thomas started to reconsider the estimate he had once done at there being intelligent life off planet Earth yet close enough to visit us. By the time he was enjoying his desert Thomas knew he had resolved the *Fermi Paradox.*

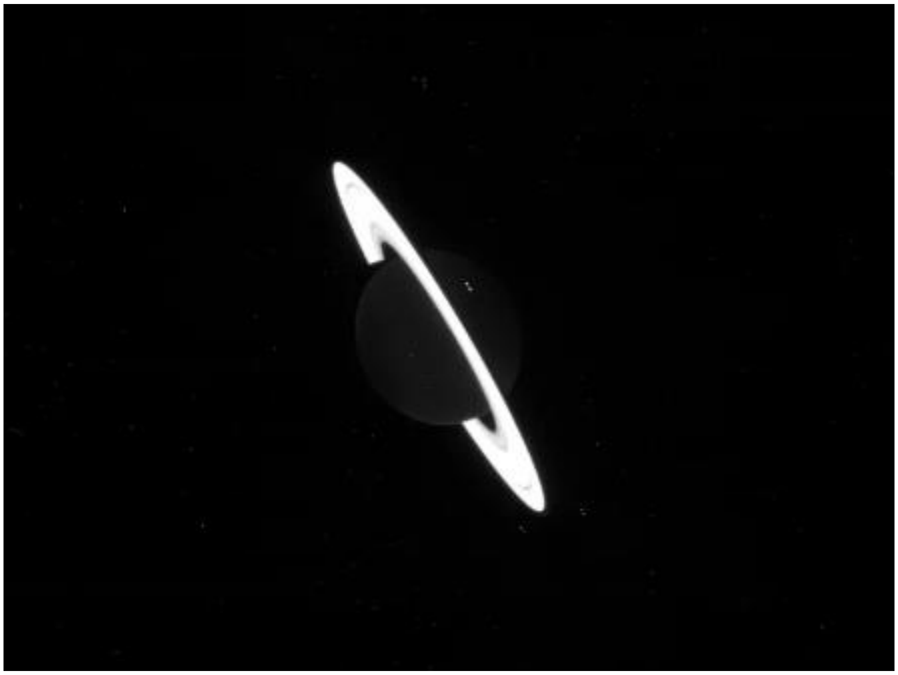
There is intelligent life in outer space, they had come to visit our solar system, were nearby and therefore the Probability was One …

Chapter 6 – There's Something Odd Out There

The James Webb Space Telescope clearly tracked the seven objects making up the *string of pearls*. The proximity of the Oort Cloud to Earth made the tracking rather easy. Sure distance is relative, but given its normal regions of study, billions of light years out into deep space, the taking of images near or within the solar system was considered close to home by the *Webblies* … as they called themselves. It was odd that the objects had an inherent temperature nearly that of their surroundings.

If you did not suspect some seven objects was there to be found, their temperature profile could easily be considered only 2-sigma above the temperature of surrounding objects and therefore not statistically significant. The central feature was most prominent in the far infrared, followed by the next largest features down to t smallest which was just within the capability of the cryogenic FLIR sensors on the James Webb Space Telescope

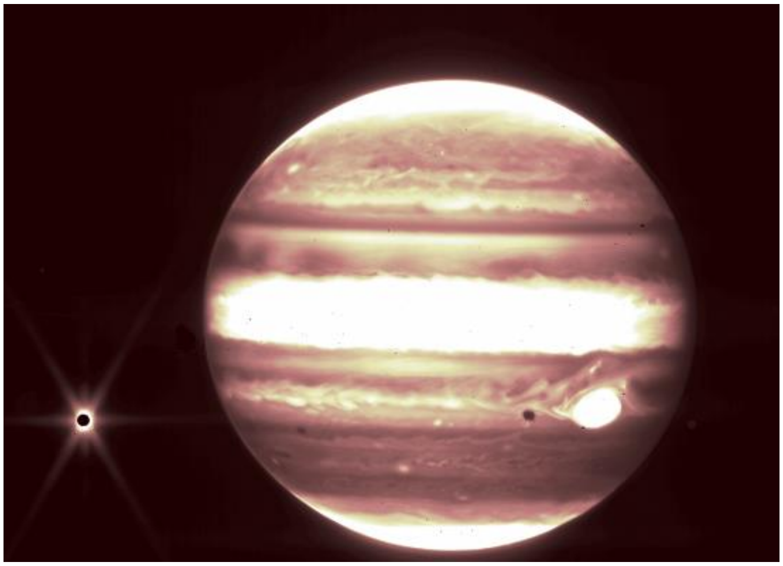
The operators of the James Webb Space Telescope enjoyed taking what they called "post card pictures" of objects near or within the solar system. Their most favorite object was by far taking infrared pictures of Saturn, its rings and its moons.



A Post Card of Saturn (NASA / JWST)

For reasons of security they signed special non-disclosure agreements with the US Government and were not allowed to take and keep “post card pictures” of the objects in the *string of pearls*. What they saw awed them, then perplexed them, then brought on another state of mind when it dawned on them why this survey was being done off the books and under a very strict and stringent non-disclosure arrangement. In a universe of strange objects this was the strangest object they had encountered so far in the universe! This could not be an object made by random processes!

The central object in the *string of pearls* was not that much bigger than Jupiter yet was emitting far less infrared irradiance than Jupiter was.



A Post Card of Jupiter (NASA / JWST)

The *Webblies* could estimate the amount of thermal light the five objects in the *string of pearls* were emitting but it did not make much sense to them!

When they plotted the thermal spectrum from the *string of pearls* they had multiple peaks. That was not surprising since there were seven objects in the set, but they only had four peaks … there was a pairing in temperatures based on the order and size of the objects in the *string of pearls*.

What the *Webblies* measured of the *string of pearls* was like distinguishing between a thermal picture of a palm of a hand at full view, compared to a thermal picture of the hand end on with only the fingers visible. Sur it was the same structure, a hand, but in different orientation you measured a different profile. The *Webblies* concluded that since radiation leaves perpendicular to the surface of a luminous object, you can drastically alter the thermal profile of that object merely by altering its orientation. End on it would appear to have a lower thermal temperature merely because the pixels in your instrument averages over the area of space you are measuring. The cross sectional area of a finger compared to area of the entire palm is in a ratio of perhaps one to one-hundred and fifty. The FLIR measurement would be reduced accordingly.

There was a healthy discussion among the *Webblies* as to what they were in fact measuring. The refined profiles were anomalous, and could only be possible if there was a somewhat hotter object at the center of the *string of pearls*. But their large scale thermal scans showed there not to be an object all that significantly hotter at the center of the *string of pearls*!

Could there be a structure masking away infrared electromagnetic energy – and if so – what would be the mechanism? Nothing natural could do this. In their natural state, over time spherical objects tend to thermalize.

To make matter even stranger, when you took off axis measurements of the thermal spectrum with the James Webb Space Telescope you arrived at the expected temperature of the Oort cloud – the temperature of deep space. So there was no second order thermal signature. Perhaps a look in the visible spectrum would help?

The *Webblies* called in a favor with the Hubble Telescope crew and they sneaked a peak in the visible part of the spectrum … but to their chagrin nothing out of the ordinary appeared. The Hubble crew were in fact annoyed at the *Webblies* for asking to commandeer a good dozen hours of their rapidly aging telescope time to just look at the Oort Cloud. The Hubble's two main inertial platform gyros had begun to wobble. The Hubble crew were holding their breath. It would not be long before they would once again become the *Hobbled Telescope*. Observing time was precious.

A few days later some Hubble operators were seen wearing freshly minted t-shirts that announced "*The Oort Cloud is boring*!" But the *Webblies* didn't take the bait. They were under strict and stringent orders not to talk about what they were working on. In fact they were told to say to the Hubble crew their measurements were for calibration purposes.

Once the news broke about the *string of pearls* the Hubble crew will kick themselves for not teasing the *Webblies* enough to get them to open up and share with them the big secret.

A few hours into the James Webb Space Telescope observations there was a brief flare of light that lasted for a split second, almost as if someone opened and then quickly closed a door. Then after 18.75 days another repeat of the short flare. When they predicted when the next flare would occur they were bang on with their prediction, after taking into account the extra distance the light had to travel to Earth.

They were encountering a process that repeated periodically exactly every 450 hours. *Webblies* debated what might be causing this effect. Then someone noted that 2 x 9 x 25 = 450. Then someone quipped but 450 = 15 x 30.

Then another factored in terms of primes, $2 \times 3^2 \times 5^2 = 450$.

Then the imaginative flood gates opened

$$450 = 360 + 90 = 360 + 60 + 30 = 240 + 120 + 60 + 30 \ldots$$

The number 450 could not be a coincidence! What in the world was the meaning of this?

The *Webblies* were not the only ones pondering this numerological peculiarity. At the Astrophysics Institute the lights were burning late into the night analyzing the implication of 450.

Thomas, with his bright young mind was pondering about this '*something so odd*' going on with the central feature of the *string of pearls* … why 450?

Chapter 7 – Towards a Distant Rendezvous

When the *string of pearls* committee began their discussions behind closed doors and amidst great secrecy as to how to rendezvous with the object, the first option, the traditional chemical rocket was immediately deemed far too slow. It would take many decades to reach the *string of pearls* using chemical rocket.

The committee then evaluated the second option of using a nuclear rocket but this was deemed far too problematic. Sure the specific impulse for the system was an order of magnitude greater than that of chemical rockets, but the risks and hazards were just far too great. Besides how would an extraterrestrial civilization view its first encounter with Earthlings, with nuclear rockets involved?

The third option was using solar powered ion propulsion and while it was a shorter duration trip, it was still not short enough. As you get further and further away from the sun the arrays have to become larger and larger to insure adequate electrical power. This meant the payload became a smaller and smaller percentage of the mass of the entire structure. This option was just not viable.

The fourth option was to use nuclear electric ion propulsion, but it would take years to design build a craft for a rendezvous mission to an object deep within the Oort Cloud. Besides the anti-nuclear crowd made even this hybrid nuclear/ion option politically dicey.

The Fifth option, a Project Orion type craft, using exploding directed energy weapons, was a still born. Only one member of the committee suggested this and he was from the United States Air Force. When the Lieutenant Colonel would not let the Project Orion option drop he was quietly replaced by a retired USAF officer who was also a retired astronaut.

Hesitantly the committee turned to their final option, the *Breakthrough Starshot Initiative*. They quietly chose the option of using solar sails for long distance rendezvous mission to the *string of pearls*. To begin with, the idea looked good on paper, but it was when they began to study the details closely, that this option also began to seem more and more problematic. The *Breakthrough Starshot Initiative* seemed theoretically possible but was technologically somewhat challenging, to say the least.

After the original media hype for the *Breakthrough Starshot Initiative* concept died down a few decades ago, a joke began to make the rounds among techies in the Astrodynamics field– BSI stood for BS & Impossible. The *Breakthrough Starshot Initiative* was the concept of using a laser array to accelerate small spacecraft, solar sails the size of a small children's kite, to a speed of a fraction of the speed of light.

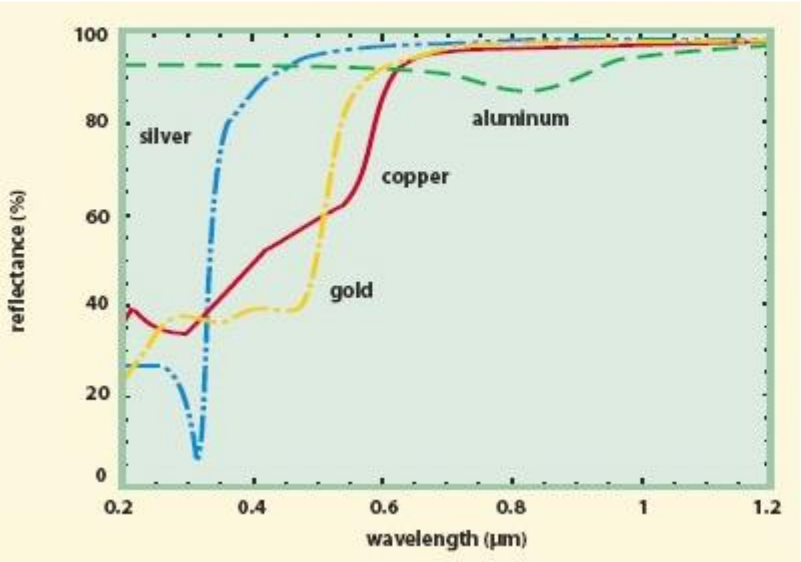
The original mission for BSI was to a one way trip to Proxima Centauri, 4.25 light years away, in a space flight that would last two decades! The spacecraft were to be aluminized mylar solar sails with payloads made up of self-repairing, distributed microprocessors. They needed to be self-repairing because the probability of hitting microdust particles were so high that unless they were self-repairing none of the spacecraft might survive the two decade long journey. A swarm of perhaps 10,000 such tiny space craft would be sent on this voyage and the law of large numbers applied. The small spacecraft would be programmed to swarm compute in flight and then after surveying the Proxima Centauri exoplanetary system to act as a giant array transmitter to send data back to Earth.

While the *Breakthrough Starshot Initiative* concept were a quantum leap over clunky traditional interplanetary spacecraft and first generation solar sails, the BSI spacecraft were still not really optimized for practicable flights to interstellar distances. Their mylar solar sails were far too thick to be considered efficient.

Several decades after the *Breakthrough Starshot Initiative* was first proposed, a suggestion was made to build a high efficiency composite solar sail using Graphene as the base material, overlaid by a fractal pattern made of thin gold wire. This concept was publicly recommended by a nuclear astrophysicist and subsequently widely circulated at NASA. The Graphene- Gold composite design greatly reduced the per square meter mass density of the solar sail by 95 % over simple mylar materials, while significantly improving the performance of the solar sail.

The recommendation was to first make nanomachines that could be programmed to make perfect reproductions of snowflakes using a template, then to modify the nanotechnology to make Graphene backed solar sails out of a carbon. The idea was presented as a challenge to nanotech researchers in a scholarly paper:

Graphene is so thin that it is transparent to visible light, so something needs to be done to make Graphene reflective. Atop the Graphene substrate a fractal pattern of gold wire would be set down, using Gold because it was an efficient reflector of infrared light, was non-corrosive and had better physical and chemical properties that aluminum, copper, or silver. Over time aluminum, copper, or silver would oxidize even in the expanses of deep space, reducing their overall reflectivity.



The part of the spectrum of electromagnetic radiation that the solar sail would operate in is the Infrared, which is beyond 0.6 µm, and Far Infrared, which is beyond 1.0 µm. The nice thing about the concept is only a few kilograms of Gold was needed in the Graphene-Gold solar sail, making this concept somewhat affordable, even if the joke was that the idea was in fact ‘gold-plated.’

From its inception, this novel composite Graphene-Gold solar sail design looked very promising! This novel design was also taken up for active research by the

CNSA, JAXA and the ESA scientists. In short order a solar sail space race ensued – who was to be the first to make a composite Graphene-Gold solar sail and launch the first long-duration, deep space mission.

When the novel Graphene-Gold solar sail design was announced it was also suggested with some skepticism that instead of exploring Proxima Centauri, a tiny and insignificant red dwarf star, it made better sense to explore the much bigger and more interesting star Tau Ceti.

Just because Proxima Centauri was the closest exostar to our Sun was hardly the point to the BSI skeptics. Sure Proxima Centauri had exoplanets however Tau Ceti was a G-type star like our sun only twelve light years away which had two mega Earths in its habitable zone. There might be lower forms of life, such as bacteria and small insects on the exoplanets in the Proxima Centauri system, perhaps because the central star is a red dwarf, however, there might be higher forms of life on the exoplanets in the Tau Ceti system because that star emitted in the visible spectrum.

qwert

Being logical doesn't always prevail … factions formed, *Proximanists* on one side and *Taucetists* on the other. In short order neither side was talking to the other and no one from the *Breakthrough Starshot Initiative* could talk with one side without being on the receiving end of ire from the other side. Consequently, the whole BSI thing spun into a tangled mess. After over a quarter century of research and development it looked like BSI would never leave the lab nor ever enter outer space.

Then along came the *string of pearls* discovery, at a distance much closer to home than either the exostars Proxima Centauri or Tau Ceti. The Oort cloud is a mere fraction of the distance to Proxima Centauri. Feasibility studies and discussions played out behind the closed doors of the string of pearls committee and a consensus quickly was formed to send a dozen laser irradiated solar sails with instruments attached to the orbit of the *string of pearls* at 2,172 Astronomical Units from the Sun.

The SoPBSI spacecraft would be bigger than a playing card yet smaller than a bread basket. It was a miraculous realization that it would only take a handful of months and not several decades for the spacecraft to make the journey from Earth to the *string of pearls*. It was decided to propel the SoP spacecraft using three square carbon dioxide infrared laser arrays situated 120 degrees apart from each other on the equator of the moon to power the SoPBSI Mission.

And who had a front row seat to all this excitement? He was ten when he discovered the *string of pearls*, fourteen when they launched the SoPBSI Mission of exploration to the string and sixteen when the spacecraft arrived and began their survey of the strange object.

By sixteen he had also completed his Ph.D. in nuclear astrophysics and was just old enough to drive a car instead of a bicycle to the Astrophysics Institute.

He will always remember the day the first images arrived. The splendor of the seven objects seen so close up could not be put in words!

Chapter 8 – The Day the Earth Changed Forever

Science is so marvelously spectacular that scientists have gotten used to expect the unexpected, the novel and even the surreal. Society as a whole, outside of the scientific community and perhaps outside the Science Fiction community as well, is rarely ever ready for the unexpected, the novel and the surreal.

When the unexpected happens with the general public paranoia begins and eventually panic ensues. Out comes the kooks, the conspiracy theorists and the clowns.

The introduction of the novel unsettles the lay person. Novel events bring anxiety, alarm and disbelief among the general public. History has shown that time and time again the general public rarely has an open mind to fundamental change brought on by important or ground breaking scientific discovery.

It was a New York Tabloid that broke the news about the first close up pictures of the mysterious object orbiting within the Oort cloud. They had received an anonymous tip and followed it up enthusiastically. The sensationalist broadsheet published an exclusive about how anonymous senior NASA scientists had discovered evidence of alien life just past the orbit of Pluto.

Like *Chicken Little* who squawked that the sky was falling one time too many, the New York tabloid had made the alien life announcement so many times before that originally no one took much notice of their story this time around. Sure it was front page, but it could not top their past exclusives about alien hotels on Mars, a crashed alien taxis on the Moon and the alien holiday hot spring and luxury spa at the south pole of Enceladus.

It was only when the F.B.I. raided the New York tabloids's office and seized the computers with the background material to their Oort cloud story that the main stream news media knew something real and substantial was afoot. Perhaps the alphabet soup types … the FBI, the CIA the DIA, the NSA … should have left the tabloid's extraterrestrials tale to wither all by itself.

Instead the F.B.I. raid was like poking a dormant hornet's nest. Out came the stingers and zingers …

The New York Times, *Washington Post* and *LA Times* descended whole-scale onto the story in search of tangible leads. So did the television and internet media, and then the kooks, the clowns and the inevitable conspiracy theorists.

The *Washington Post* pronounced the whole matter *Aliengate* and soon the story of object in orbit in the Oort Cloud became a media frenzy.

As the snippets from separate and bonafide sources within the US Government and NASA were pieced together the journalists realized that for the first time this story about aliens and extraterrestrials was not a hoax, but '*the real McCoy*.'

Indeed it was the real deal! Evidence of an alien civilization had been found in a group of seven objects clustered close together orbiting the Sun, and to add to the veracity of the story … the objects had had been found near to the Solar System and far less than a light year from planet Earth. It had also been in orbit for a long time, which sort of took some of the sting off the story. Had it just arrived more panic set in … but since it had been there for some time … how long no one knew … that sort of calmed the public down somewhat.

That Friday afternoon the press swarmed to the White House. That very day the President retired for a "well-earned rest at Camp David." That Friday afternoon there was a pot boiler of a press scum. The Press Secretary at the White House tried as best she could to dodge the questions and then resorted to the usual, "I can neither confirm nor deny the story…" which meant to the press that without a firm denial, the story might in fact be factual. Then the parades of concerned citizens began and even Marvin the Martian was seen marching in front of the White House.

The Washington press then tried to give chase to the White House Science Advisor. When he finally appeared all he could say was "there is indeed something out there. We are not quite sure what it is. We shall keep you posted as we learn more about the objects …" He weaseled out of all the questions asked him. The journalists started to associate the White House Science Advisor with a cover up. Smugly the

Washington Post gained traction with his picture on their front page and the byline *Aliengate* ...

Later the following morning many main stream astronomers ran for cover when they caught wind that the media was heading their way. Even Avi Loeb at Harvard seemed reticent when asked. His favorite reporter at the *New York Times* had to chase Dr. Loeb for two days before he returned her seven telephone calls.

The following morning she took the very early Amtrak from New York to Boston to meet Dr. Loeb for lunch at the Harvard Commons. She was taken aback when, over her *Salade Niccoise* and red wine that it was Dr. Loeb all but interrogating her about the story, as opposed to her interviewing him, which was the usual routine.

Her sixth sense told her that he knew something, but no matter how hard she tried to draw him out he wouldn’t open up. She returned to New York later that evening and filed her story enroute. *Famous Harvard Astronomer Tight Lipped* was the banner to her story.

The following morning Dr. Loeb gave an interview to the Boston media in his office at Harvard, and managed to lob the ball back at the *New York Times* asserting the Times knew more than it was reporting.

For some strange reason the media did not circle their wagons around the Astrophysics Institute, which seemed suspicious until you presume the best lead for this story was coming from someone within the Institute. Indeed the lead did emanate from the Institute. It came from the Director herself, for experience had taught her it is far better to lead a story than to follow one.

She was in her office when Avi Loeb called. Though she was exhausted after forty eight hour of non-stop work she took the call. She listened and heard the exasperation in Dr. Loeb's voice … "but Avi it was you who approached us and not the other way around … she did, did she! No I have not seen her story. Can you send it to me?"

The discussion was over in a few minutes but it seemed to her like the whole conversation had taken longer. Time is psychologically relative to your state of mind. When you are waiting for something to happen times seems to slow. When you are exhausted time changes its pace.

Then the phone rang a second time. Her secretary told her it was the journalist from the New York Times. She smiled as she took the call.

"Hello … yes this is the Director." She stooped and listened for a few seconds.

“Aliens where … The Oort cloud. Anyone confirm this?” She listened half-heartedly. “Oh … I see … the White House could neither confirm nor deny …”

She placed her head in her hand and closed her eyes and as she listened her exhaustion finally hit her. “Do I have anything to say?”

She leaned back in her chair, paused, then smiled and said “… if this news is in fact true … today is the day the Earth has changed forever. Yes, you may quote me . Thanks, ”

She set the telephone back into its cradle, not bothering with the goodbye niceties. Then she closed her eyes and fell soundly asleep in her chair, something she had never done before. Dr. Aristo was exhausted from the wait, but now that the story has broken she could now catch up on her sleep.

When Penny, her secretary, looked in a bit later she knew to let her sleep.

Chapter 9 – A First Look See

At a distance of 2172 A.U. the time it took for the electromagnetic signal from the SoPBSI-1 spacecraft to make it to Earth was over twelve and a half days. The first pictures from SoPBSI-1 started to arrive two months before the point of closest encounter. It was not expected that SoPBSI-1, the first of several planned SoPBSI spacecraft, to do anything except a fly by.

Once the trajectory of this first gravitational encounter was analyzed subsequent SoPBSI spacecraft will have their trajectories modified accordingly so that perhaps the third or fourth of the dozen sent could be piloted to enter an elliptic orbit around the central feature of the *string of pearls*. They aim to set SoPBSI-6 into a circular orbit around the central feature.

Thomas did not sleep for much of those two months, or for the two months afterward the SoPBSI-1 fly-by. He had taught himself to sleep two hours at night, nap for an hour mid-afternoon and take a cat nap of 20 minutes when he felt tired during the day. But most of the time his mind was on overdrive.

They had set up an office for him next to the Director's office and they had let him be free to decide how to use his time. Unofficially he was just another member of the Institute but Dr. Sally Aristo made sure everyone deferred to Thomas when it came to the *string of pearls*. It was, after all, his discovery.

In return, Thomas had helped Dr. Aristo to decipher the origin of the *Tetrahedral*. The isotopic composition clearly pointed to the Oort Cloud as their origin and hence the string of pearls for want of any intelligent presence in the Oort Cloud. The clues had been subtle but he had worked them out. It had been sort of a numerological enigma which when you set the atomic mass unit and isotopic compositions into a 450 dimensional space slowly unraveled itself.

His conclusion, the were *Tetrahedral* nothing more than geographic markers meant to aid extraterrestrial spacecraft to navigate in the proximity of the planet or moon they were located. Just a few months prior to SoPBSI-1's fly-by a team from China discovered *Tetrahedral* at the North and South poles of the moon Titan.

Then a bit of serendipity set in. When the Chinese Taikonauts illuminated the Titan *Tetrahedral* with violet-blue laser light they fluoresced with such intensity that the *Tetrahedral* could clearly be seen in orbit. The *Tetrahedral* were in fact able to amplify the intensity of a specific frequency of violet-blue laser light a billion-fold.

It was Thomas who deciphered what the *Tetrahedral* were about. It disappointed many scientists who had expected something much more. Thomas thought that the *Tetrahedral* were mere survey markers set down by an alien civilization. Their surfaces polarized the specific frequency of violet-blue laser light selectively so that the amplified light from the survey markers set out specific quadrants north and south of the planet or moon they were located. The polarization was accomplished at the atomic level and was uniform across each face of the *Tetrahedral*. This was amazingly simple yet amazingly complicated all at the same time.

Thomas would not admit to anyone else that he was disappointed with this discovery, but he did admit to himself that it was a disappointment and pushed himself to set the whole *Tetrahedral* enigma behind him and focus on the upcoming close encounter with the *string of pearls*.

But he had a very hard time putting the *Tetrahedral* enigma behind him. So did Dr. Aristo, who admitted to him she had expected more of a meaning than just something so meaningless practical.

The day he announced that the *Tetrahedral* were merely survey markers set down by an alien civilization, just to relax he decided to invite Dr. Aristo into his office to watch with him the old classic film the *Hitch Hiker's Guide to the Galaxy*. He stopped the film just after the 42 disappointment and explained to Dr. Aristo that many years ago someone had deciphered the meaning to the 42 enigma.

"The number 42 has a meaning?" Sally was astonished.

"Sure, it does," he said seriously.

"I thought Douglas Adams was just making a joke at the reader's expense!"

"No … in fact he was being quite serious!"

"Serious!   Thomas don't tell me he was being serious!" Sally said incredulously.

"The number 42 converted into binary was 101010 which means that the meaning of life is …" then he whistled the part as he said the words …" I owe, I owe, I owe … and it's off to work I go!"

Sally began to laugh hysterically when she took in the punch line. "Thomas you are the smartest man I know …"

As a gracious retort he said to her "you are the smartest woman I know …"

Dr. Aristos paused for a moment of thought and then asked Thomas "what is your view of the possibility of intelligent extraterrestrial life?"

Thomas smiled. That is an easy question to answer. It is inevitable that there is intelligent extraterrestrial life somewhere in the Universe. It is inevitable because of the probabilistic law of large numbers … even is something has a small probability, in a large enough sample space it becomes possible."

Dr. Aristo smiled and said “I have asked many astrophysicists this very question but you are the first who has given me a definitive opinion.”

Thomas frowned. “You are not correct to call it an opinion …”

“Why am I incorrect?” She responded.

“Isn’t it obvious?”

“Oh … you mean your string of pearls!” Dr. Aristo said this with gusto.

“Yes …It is one thing to sit down, write out the Drake Equation, plunk some theoretical numbers down, drink coffee and be philosophical. It is another thing to base your ‘opinion’ on real data.”

“Yes … indeed! I once met Dr. Drake and we discussed the numbers. He had read my essay *Oh My, where are all the Aliens?* and enjoyed the essay.”

Thomas sighed. “Dr. Drake lived a bit before my time. We now know that he was partly correct and partly incorrect … there are many exoplanets but most of the exoplanets orbit M-dwarf stars.”

“Still we have found a few Earth like planets orbiting G-type stars … at just the right distance from their stars to be in the habitable zone.”

“But you do appreciate that the Search for Extraterrestrial Intelligence has now been going on for a century and still no joy …”

Dr. Aristo could not miss her chance to ask. “Have you ever wondered whether the SETI people are basing their search on false premises? ”

Thomas spoke earnestly. “*A prior* scientific research is always like that isn’t it? You have to accept some assumptions when you set out to study phenomenon and then see where these assumptions might take you. ”

“And then sometimes there are surprises … like the string of pearls. There appear to be no radio emissions coming from the objects.”

“And they sure know how to hide themselves away, don’t they.”

Dr. Aristo got up out of her chair and made her way to the door, “Shall we go back?”

Thomas nodded and stood up and followed her to the elevator. Penny was not at her desk when they walked through the anteroom to the Director’s office..

In the right frame of mind they drifted back to SoPBSI ground control on the top floor of the Institute and waited for the day's telemetry from the SoPBSI-1 spacecraft.

"Dr. Aristo … I think we should put a special instrument on SoPBSI-6 before we set it on its way." Thomas whispered to her.

"Let me guess …" she whispered back, "a violet-blue laser …" She had read his mind.

"Yes … a violet- blue laser set to 450 nm."

"What do you think will happen if we shine that frequency at the *string of pearls*?" She queried.

"Hopeful not something disappointing." Thomas paused before he considered. "The choice of that wavelength for navigational purposes might mean that the wavelength may have other practical uses."

A voice in the front of the dark room said "we're ready …" then the first pictures of the *string of pearls* from SoPBSI-1 were projected up onto the front wall.

While the smaller pearls were specular in their reflectance, the central feature appeared less so. It appeared rougher in its surface characteristics, almost diffuse in its reflectance. Thomas had not expected this. He smirked. He had prejudged that the seven object might share similar reflectance, but gladly had not shared this prejudgment with any of his colleagues.

“What’s wrong?” Dr. Aristo asked him.

“Nothing …” He tried to hide his disappointment.

“Something must be wrong. I don’t often see you grimace.”

“It’s a pity our first close pictures of the *string of pearls* are still so granular.”

She explained to him the obvious. “The pixel resolution will get much better as we get to the point of closest approach.”

He nodded. “When can we expect the first spectral images?” Thomas asked Dr. Aristo.

“Let me go ask …” and she disappeared into the darkness.

He moved his eyes back and forth across the central feature and convinced himself that the surface of the central feature had a texture to it. He smiled.

Suddenly Dr. Aristo appeared out of the darkness. “By this time tomorrow. Why are you smiling?”

“I think the central feature has texture.”

She turned around and looked back at the big screen. “I can’t see that … you must have very good eyesight to see texture.”

A voice from the front of the room asked “what would you like us to do with these first pictures?”

Dr. Aristo pointed at Thomas. Thomas responded. “Can you do a Fast Fourier Transform of the texture of the central feature?”

Dr. Aristo piped up “and make sure you remove any artifacts due to pixilation.”

“Can do …” responded the voice from the front of the room.

“What do you think?” asked Dr. Aristo.

“Ask me this tomorrow when the first spectral data is in and the FFT has been done.”

Dr. Aristo put her hand on his. Her hand was very warm. “Beautiful aren’t they?”

He nodded solemnly. Then the two of them just sat there in the back of the control room, silent and deep in their own thoughts about the first pictures from SoPBSI-1.

Thomas wondered how these first images of an extraterrestrial object so close to Earth would be received by the anxious public. He thought how he might explain their significance. Then he had visions of him in front of the press at a press conference. This thought sent a cold chill down his spine. He turned to Dr. Aristo and asked “what are we going to do about the pictures?”

“Don’t fret Thomas … NASA will look after their release,” she replied.

He sighed audibly.

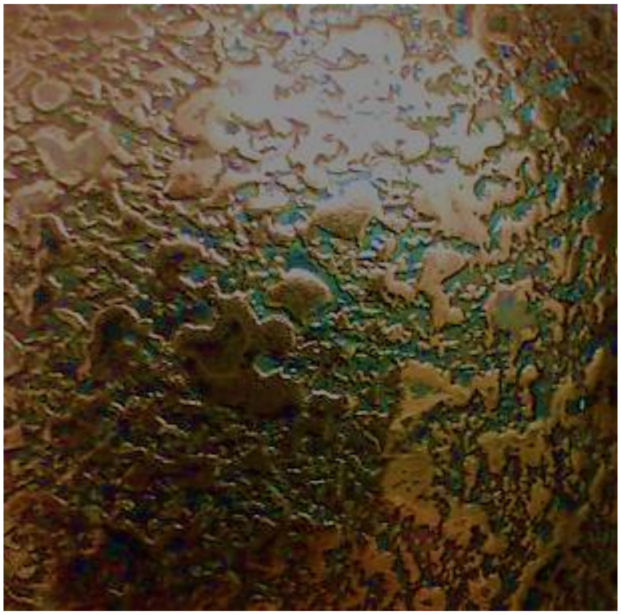
Dr. Aristo turned to him and smiled then said “NASA still has the biggest PR department anywhere in the world. The NASA Director will probably lead that charge!”

“Thank goodness …” Thomas remarked without hesitation.

“Just in case, I will get security to lock the front doors of the Institute until further notice.”

Chapter 10 – A Very Special Pattern

The following day both Dr. Aristo and Thomas were once again sitting in their usual seats in the dark at the back of the SoPBSI control station. Together they stared at the first picture of the central feature. It was an amazing and awe inspiring picture.



Dr. Aristo broke the silence. "I came in late last night and asked them to focus on a two degree offset right and a two degree offset down from the center of this picture. It seems to have some interesting details."

Thomas concurred. "Yes it does … we can analyze other sections of this picture later."

They waited as the results of the Fast Fourier Transform were being uploaded on the big screen. There were a dozen power point slides in the presentation. Each of the slides conveyed details that were not easily seen in the full picture of the *string of pearls*, but became visible when the seven objects were analyzed individually using a Transform. It was maddening though the object that seemed to give up its secrets most hesitantly was the largest object of the group, the central feature. The FFT had shown there to be a multitude of textures on the surface of the central feature.

This gave Thomas an idea. He turned to Dr. Aristo and asked her in a steady and quiet voice, “should we perhaps also ask them to do a Fractal Fast Fourier Transform?”

Sally smiled, “sure why not.”

Thomas continued. “A Fractal FFT might tell us about any self-repeating tiling on the surface of the central feature.”

“Do you think there might be tiling?” Dr. Aristo asked.

Thomas spoke clearly and emphatically. “It might be my imagination, but when we took our first look at the central feature I swore I could see some sort of tiling.”

“Fine … I will go and task them to do a FracFFT.”

“Do you think they will mind,” he asked.

“No… they are in fact thrilled to be working on this project and they are very eager to be the first to learn all about the *string of pearls*.” Sally got up from her chair and said “the more analysis … the better we might begin to understand your fascinating discovery. “

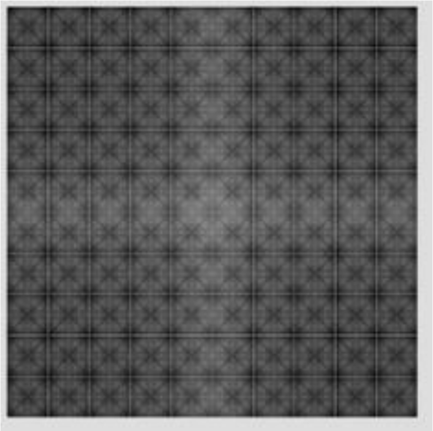
Dr. Aristo turned and ambled down the steps of the raised seating and downward to the front. The very front of the SoPBSI control room was called ‘*The Pit*’ by the controllers. All the young, upcoming and eager controllers were down in ‘*The Pit*’. Sitting down there was akin to sitting in the front row at a movie theater. As you worked your way back from the front to the read of the darkened control room, people took on less responsibility as to the day to day details of the mission. All the real techies were down in ‘*The Pit*’.

It was good he was now alone and in the dark because Thomas felt embarrassed every time the older professor deferred to him as her younger colleague. He could not control his blush response. His colleagues long ago had begun to have fun with him trying to get him to blush. Even the secretaries took turns seeing how red face they could make him. He was definitely more comfortable with the ways of astrophysics as opposed to the ways of day to day life. For the secretaries they were more at ease with life. Their eyes glazed over when people tried to talk astrophysics to them.

One of the secretaries was an exception. Instead of making Thomas blush she would blush whenever Thomas chatted with her. Thomas took an inner pleasure in this and so he went out of his way almost every second day to find a reason to chat with her. Penny was about his age which made matters even more interesting for him. The other secretaries could not help but notice this special interaction and so they took to getting her to run the little errands to and from his office so to encourage what might eventually become something more than just cordial.

Dr. Aristo emerged from the darkness. “I have a bit of a surprise for you. Someone went out of their way and did a Fractal FFT this morning. They will put the results up the big board in a minute. They tell me that its results will knock your socks off …”

Thomas squirmed in his seat as he waited. The first image appeared on the big screen. Then went perfectly still. His jaw dropped and his eyes went as big as saucers.

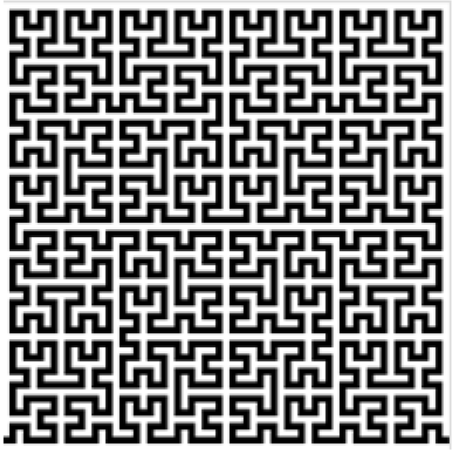


“It’s a Hilbert Curve.” He said almost breathlessly.

“A what?”

Thomas took out a wooden HB pencil from his jacket and opened the folder he had in his hand, took out a white piece of paper and began to sketch. In a minute he showed Dr. Aristo his sketch of a fractal Hilbert Curve

He explained to her, “the Hilbert curve is a space filling curve first described by David Hilbert in 1892. It is a curve that visits every point in a square grid with a size of 2×2, 4×4, 8×8, 16×16, or any other power of 2.”



Dr. Aristo turned to stare at the big board. And what large scale measure do you think the grid has on the central feature?”

Thomas closed his eyes, as he prone to do when thinking through a complicated idea or undertaking an intricate calculation.

Just then out of the darkness appeared Thomas’ favorite secretary. He knew she was there without having to open his eyes. He could smell Penny’s perfume and her pheromones. Her presence and her fragrance interrupted his train of thought and he opened his eyes with a start.

“Sorry to interrupt you Dr. Tipler ... but your mother stopped by with your lunch.”

“Thanks Penny …” He smiled at her, as she handed him a plain paper bag and then said. “… perhaps a light second ....”

“Come again?” Penny was perplexed.

“Oh … I am sorry … I was doing a calculation for Dr. Aristo. It appears to be as big as the orbit of the moon around the Earth at least.”

“I hope I did not bother you!” Penny said self-effacingly.

Before he realized what he was doing Thomas said "… you never bother me," caught himself and started to blush.

Dr. Aristo smiled and suddenly got up from her chair and said "I need to make a telephone call. We can analyze the fractal FFT of the central feature after lunch." She turned to Penny and with her hand offered her the seat she had just vacated.

Penny said, "but the admin staff is not allowed to stay in the control room."

Dr. Aristo walked passed Penny and said "keep him company for lunch. It will take his mind off the *string of pearls*."

Thomas looked up at Penny and stuttered. "My mother made two sandwiches but I have only an appetite for one. Would you like to join me for a sandwich?'

Penny smiled brushed back a bang of hair and sat down next to him. "Thank you Dr. Tipler …"

"Call me Thomas … or Tom … you decide."

Penny looked up at the big board and smiled. "Hilbert Curve?"

“Yes … how did you know that?”

“My father was a math prof, and I studied mathematics at university.”

And so began a rather unique conversation that cemented a companionship between two bashful and blushing friends.

When Dr. Aristo returned they had both finished their sandwiches and had both talked about the polymath David Hilbert and his math. When she saw the Director approaching Penny got up to give her seat to her.

Thomas placed his hand on her arm and said “… would you like to have lunch with me tomorrow?” Penny smiled and nodded, then disappeared into the darkness.

“She’s very nice isn’t she?” the Director asked as she sat back down.

In the darkness all that Thomas could do was blush.

Chapter 11 – Panic Sets In

It was a Friday night of a long weekend when the White House Press office finally called in the correspondents to release an official statement relating to a discovery of the strange and exotic objects in the Oort Cloud. The Press had been hounding the President for months for confirmation about rumors relating to an object in the Oort Cloud and extraterrestrials.

One newspaper, The LA Times, put a story titled *Aliens in our Midst* on their front page but many readers skipped the story thinking it was about illegal immigrants sneaking in from Mexico. Afternoon television talk shows slocked the subject to pander to their domestic crowd, hoping to boost their ratings. The late night comedians jumped in and made a mockery of the whole matter. Within minutes of the first news story the internet had a flurry of opinion pieces, some based on fact but most based on pure and unabashed fiction, then the kooks flooded the bandwidth with nonsense. Countless crack pot and crazy rumors fed the whole madness.

Since the story broke the President had stone-walled the press, not because it was his style to stone-wall them, but merely because he did not know what to say to them. Science wasn't the President's forte. He had been a Hollywood B-rated actor, before becoming Governor of the State of California for two terms at age forty, then President of the United States a few years later. He had been born the same year that his idol Ronald Reagan has passed away. And now at age 68 he was midway through his first term. Aiming for a second term.

The last thing he needed to mar his ‘*Good Times are Here Again’*, message is bad news about aliens from outer space.’

It was always the same. Every second day he would ask his Chief Science Advisor Dr. Marco Pavan, for an update and every second day this academic would weasel him. When he was at M.I.T. the good professor was a non-entity. He blended in with the wall paper. When M.I.T. realized he was running an illicit business and had been grifting them, they invited Dr. Pavan to take his business elsewhere and find a position in industry. What Marco had been doing while blending into the wall paper, was go to seminars and symposiums, drift through the labs and offices of his colleagues and listen carefully to the ideas these other people were working on and then rushed to the patent office to patent ideas he had snagged in his grifting.

Once or twice could be a coincidence but after the third grift the Board of Governors at M.I.T. had a closed-door meeting that lasted an entire afternoon, listened to the affected academics, then showed Dr. Marco Pavan the door. It was either that or be tarred and feathered by the academics he had double-crossed.

Marco Pavan then grifted around New York for a few years, tried to secure a position at NYU, Cornell and even Hunter College but no one wanted him. His reputation had preceded him. When he had outlived his welcome in New York he figured it was time for virgin territory and so he moved clear across the continent to the West Coast. He spent a few years at a research institute in Vancouver Canada associated with the University of British Columbia, realized he was adrift in a sea of numerous other grifters and then decided to move south to the world of opportunity in California.

When he arrived Marco Pavan weaseled his way into LA Society and eventually made friends with the Governor of California. He took to drinking beer, riding horses and enjoying BBQ's so as to build a rapport with the Governor then grifted his way into the Governor's entourage.

Had they done a proper due diligence the Governor's advisors would have not invited in to the circle as the Governor began his quest to be the Republican nominee for the Presidency. When he parted ways with M.I.T. both parties had formally and officially agreed to keep the reason behind their separation secret. When asked, the good professor would say with a smirk that M.I.T. had outlived his usefulness and was no longer an interesting place to work. That M.I.T. no longer had any real opportunities for a man with his talents. He was very smug about it.

When the Governor was nominated as the Republican candidate for President, suddenly science, technology, engineering and math took on a central role in the candidate's effort to get across his '*Good Times are Here Again'* message. And so Marco became the candidate's *weissenshaft wunderkinder*.

When the Governor was elected President, Pavan had hoped for a high ranking position at DARPA, or with NASA, but the President decided instead to nominate him to the minor role of Chief White House Science Advisor. On the surface it had some pastiche being associated with the White House and the Presidency but in fact the position was merely bureaucratic. The position of Chief White House Science Advisor had no real depth or impact on public policy. If the man upstairs did not want the recommendations of the man downstairs to be pursued then the White House Science Advisor's reports and memos were deposited into the round file.

Marco wasn't thinking much past the immediate when he accepted the invitation for now he would have to work for his keep, under the watchful eye of the President and the President's Administration. But worst yet Marco would have to follow the rules set out under the Congresses' *Transparency in Government Act* For the first time in his professional career Dr. Marco Pavan would have to publicly acknowledge where and when ideas set out by him on behalf of the President became known to him. He could no longer grift.

Marco had been in his job in the basement of the White House for three months before the first time he was confronted with this officiousness of this requirement. One of his reports had been returned to him with a large portion of the report red-lined … '*plagiarized from a M.I.T. report*.' It was initialed by the VP. The annotation said either properly attribute or remove mention in his report. The writing was like waving a red flag in front of a bull. Who was the Vice President to tell him how to do his job! He threw the entire report into the round file and cursed the fact that the United States was a democracy.

That Friday afternoon the phone rang. He let it ring five times before he answered it. Most people would give up after the third or fourth ring. He reluctantly picked the telephone receiver up. He recognized her voice immediately and cringed. It was the VP.

“I am here at Camp David with the President.”

“Unhun”, he snorted into the receiver.

“He is sending a secret service agent to pick you up.”

Marco heart stopped …. “What for!” he nearly screamed into the telephone.

“What the hell is wrong with you?”

He gulped in air and responded “nutin … what’s up?”

“The President wants a briefing on the *string of pearls* matter.”

“Doesn’t he read the memos I send him on the matter?” Marco uttered impatiently.

“Yes but there is not much to your memos! He wonders whether you have been sitting on this issue.”

There was a knock at his door. He pressed the telephone to his shoulder. “Who is it? I’m on the phone!” he barked.

“Secret Service Dr. Pavan. I have been tasked to bring you to Camp David.”

He lowered his head and meekly spoke into the telephone. “Madame Vice President, the Secret Service is here to pick me up and take me to Camp David.”

“Listen Dr. Pavan, the President is liable to ask you direct questions. You better have direct answers for him or we may have to go outside the White House for our advice on this.” The telephone went dead.

He got up and walked to the door and unlocked it. He opened the door to find a tall and stocky Secret Service agent with a buzz cut hair cut and a serious expression on his face.

“Excuse me Dr. Pavan, White House regulations say that all occupied offices in the White House are to remain unlocked during normal working hours.”

He snorted a response.

The secret service agent was unimpressed. “Gather your things needed for the President’s briefing and we shall get you down to Camp David.”

Marco took a deep gulp of air, stuffed a stack of files into his briefcase and grabbed his lap top. The Secret Service Agent took his brief case and lap top from him saying ‘it is standard procedure to vet items before going to Camp David.’

He meekly followed the agent out of his office, not bothering to turn the lights out. Someone else would obviously come and do that for him. He quickly glanced back wondering if he ever would see his office again. As he got into the dark vehicles with the smoky windows this was when the panic set in.

He never enjoyed briefing the President in person. He much rather send him the occasional well-crafted memo. He had sent a few memos to the Oval office regarding the *string of pearls* but they always returned with more questions written in the margins, questions he did not have the answer to. The verbiage in the margin questions had gotten more strident in the past few days.

As they sped to Camp David, Marco Pavan knew a set up when he saw it.

Chapter 12 – What Can We Say?

The President was happy the face-to-face briefing by his Chief Science Advisor was finally over. From the first day they had met he had not trusted the professor, as he called him. He never called him Dr. The President had escaped the weekend to Camp David in the hope he and his administration could sort out a policy about the whole *string of pearls* matter. After wasting his time talking to his Science Advisor they obviously would not! None of the President's important questions were answered.

He fell back into a chair, kicked off his shoes and put his feet up on a coffee table. One of his big toes poked out from a hole in his sock. He chuckled at the sight and then let out a long sigh. The whole afternoon had been a complete waste of his time. He had asked in the alphabet soup crowd to sit in as well as the Joint Chiefs of Staff and he could tell by their body language they too thought the afternoon a waste of their time. They wanted facts so that they could make decisions and act.

Finally at an important juncture of the briefing he had opened some newspapers and read , word for word, what was printed in them. He had gotten more background on the *string of pearls* matter reading articles by the New York Times science writers than he had gotten from his own people inside his own Administration.

Then the President of the United States stated that he would have to go outside his own administration to find his own answers. He dismissed his science advisor from the rest of the meeting, and arranged for him to be driven directly to his home instead of his office at the White House. “Take a few days off …” he suggested as the prof left the meeting room.

Their meeting continued on for perhaps another forty five minutes then he also dismissed the remaining dozen meeting participants. None knew to doddle for they all felt the President wanted to think some matters through himself. After all, it was not every day that the most important man in the free world has to deal with extraterrestrials at his doorsteps!

The President felt done in after they had left him. Still he knew not to let the matter sit. He had to sort out a policy and he had to explain it to the people in his administration … what are we actually going to do about the *string of pearls*?

Science was definitely not the President’s forte. The last time he studied science was when he took chemistry in grade 11. He squeaked through with a B+. He skipped out of taking physics and calculus. His forte in high school was history and English literature. He was also the President of his High School’s Drama Club. Then he decided to take up acting, theater, and later film, *et voila* now he was President of the United States! He knew that no scientist has ever become President. He smirked … perhaps no scientists would ever be President. What scientists would want the job?

The President glanced around the meeting room at Camp David. On the walls were pictures of all the Presidents who used Camp David going back to the 1950's and Dwight D. Eisenhower, then the 1960's with JFK, then LBJ, then the 1970's with *Tricky Dicky* … He studied the face of each man in turn and thought about each of his predecessors' backgrounds.

When he got to Jimmy Carter's picture he paused. Except for Jimmy Carter, who was one of Rickover's boys and had studied nuclear reactor engineering at the Naval Academy … like him none of his predecessors could claim science was their area of expertise.

But the President smirked. And look how long the *Braniac* Carter had lasted as President … one term, over analyzing matters to the point of indecision. The nuclear accident at Three Mile Island and his vacillation on several foreign policy matters cost him a second term in the White House.

Then along came Ronald Reagan … his idol! Ronald Reagan had known science was important and trusted his advisors to advise him of scientific matters. Reagan had achieved what he had set out to do, bring a peaceful end to Cold War and a dismantling to the Evil Empire … the Soviet Union. Some decades later a Russian President had tried to rebuild the former glories of the Soviet Union by making war with Ukraine, but with the passage of a few years, and defeat on the battlefield that Russian President was out of a job and the world was once again at Peace.

The President wondered what his predecessors would think of his present predicament. They had dealt with matters of war and peace, but this always related to humans making war with humans. He, on the other hand, had to deal with questions that were related humans and non-humans. He had to deal with philosophical questions that related Earthlings with the extraterrestrial.

He sighed. There was a quiet rap at the door.

"Come in …" In entered his valet carrying a martini on a silver tray. "Thanks Jim, you had read my mind!"

Jim, his valet presented him the drink then stood straight up. The President sipped from his martini and nodded. "Perfect as always Jim … thanks!"

"The Vice President is outside and wondered if she could have a word." Jim said stiffly.

"Just a word?" the President joked.

Jim smiled and then asked "shall I bring you another martini?"

"In a minute or two … can I ask you something Jim?"

"Yes, Mr. President."

"What do you think about this *string of pearls* matter Jim?"

There was a pause before the valet answered. "Mr. President I am loath to share my thoughts on this matter."

"Jim I have known you for several years now. Just between you and me what do you think … should I be worried?"

The valet smiled and then chose his words carefully. "Why Mr. President? I understand the *string of pearls* has been in orbit around the Sun for ages … and they seem to have left us alone. They are perhaps a very advanced civilization. We less so. We don't represent a threat to them do we? Why would they bother us now?"

"Yes … Jim … why?" The President nodded. "My Generals fear the worst and are busily drafting up war plans."

"Mr. President, why do we always assume that little green men will want to make war with us?" Jim responded.

“That seems to be the prevailing theme of Hollywood.” The President quipped.

“God help us if Hollywood makes public policy for us here in the good U S of A.” Jim said this with an edge.

“Yes God help us … It has always been my nature to trust people until they themselves give me a reason to mistrust them. Then I am more measured or careful with them. This has helped me many times in politics and many times in life.”

“Why don’t you use the same philosophy with the *string of pearls* Mr. President?”

“Yes … why don’t I? My philosophy has always been that I ought to be optimistic until I need to be pragmatic.”

“No pessimism, Mr. President? Jim asked.

“I can’t be the pessimistic one. I hold the launch keys and well … being pessimistic would not be a safe policy would it Jim? I will leave that to the VP and the Generals.”

Jim shook his head. “No … such pessimism would be the end of us all!”

The President smiled and said. “I think you are very wise Jim.”

“Thank you. Glad I can be of assistance Mr. President.”

The President leaned forward. “I should turn to you for advice more often.”

“Any chance you can convey this to my wife … she never lets me get a word in.”

“Mine too …” The President smiled. “I think I now know what I ought to do about the *string of pearls*.”

“I heard the crowd leaving your meeting … they need to know what you plan to do Mr. President. They are a worried crowd. It does not bode well to have Generals who are worried.”

The President nodded. “Can you mix us a carafe and then bring another glass for the VP?”

“Can do Mr. President … shall I let the Vice President in now.”

“Only if you must … but give me a minute to finish my first Martini.”

“Yes, Mr. President.”

He watched the valet leave and quietly close the door behind him. His Camp David valet was an old Marine Corp Sergeant and a stickler for protocol. Having asked for a minute’s respite, the ol’ Sergeant would count to sixty and give him his requested minute, irrespective of the Vice President’s perceived entitlements.

He took his feet off the coffee table and slipped back into his shoes. He took out his reading glasses and perched them on his nose. Then he got up and walked over to the bookshelves and pulled down a copy of Cicero’s writings as translated by Petrarch. He had his back to the door when the Vice President entered.

“Bob …”

The President turned, looked over his eye glasses at the VP and frowned.

“Err Mr. President.” The Vice President corrected herself.

The President pointed to a chair and the VP walked over to it and sat.

On queue the valet Jim reentered the room with the carafe and another martini glass. He poured another martini for the President and stopped. The Vice President looked up a Jim annoyed. The President waited three or four seconds before commanding Jim to pour her a martini, which he did.

The he stood up stiffly, ignoring the Vice President. “Would you require anything more, Mr. President?”

“Do you think some hors d’oeuvres would ruin my dinner?” he asked Jim.

“Most likely not sir!”

“Bring some for Vice President as well.”

“The usual sir?”

The President nodded. Anchovies on deviled eggs and rye crackers … were his favorite afternoon snack. Since his day in a Fraternity House this has been his preferred hors d’oeuvre with a cold martini. He had been introduced to the combination by an Italian girlfriend from the Bronx, to Anchovies on deviled eggs and a number of other devilish adventurous things too. She was now a dumpy mother of two girls and a boy, with a grandchild on its way.

The Vice President shuddered when she heard him say ‘the usual,’ for she knew what that meant. She hated anchovies. It reminded her of an Italian boyfriend she had once had. They had dated when she was a Sorority girl. He was as handsome as a Roman Senator but he always had fish breath from the copious quantities of anchovies he inhaled. He was a god in bed but eventually she got fed up of his anchovies and the other fishy things he enjoyed doing like peddling narcotics for his Sicilian uncles.

Her affiliation with him at University had been a cause célèbre when she was being considered as the Vice Presidential Candidate, but the fact that he had died in a motor vehicle accident soon after leaving university meant there was not much traction to this intrigue.

The Vice President took a long swig from her martini and nearly choked. She had also yet to get used to a martini made with sake, instead of gin or vodka. The President had his little foibles and everyone had to accept them for what they were.

The President carried Cicero with him and sat across from her. “What’s on your mind?”

“You need to get rid of him …”

"Him? There are a lot of *hims* in my Administration."

"Your White House Science Advisor, who else?"

"Last week it was the Secretary of Commerce, the week before it was the Director of NASA … this week it is my White House Science Advisor … who will it be next week, Cheryl." He called the Vice President by her first name whenever he needed to chastise her.

She knew this and slowly took another long sip from her martini. The President waited until she had set her now empty glass back onto the coffee table before he poured her another. Then he ceremoniously dropped an olive in it for added measure.

"Don't take everything so seriously Cheryl …I know my Science Advisor doesn't know what he is doing."

"You do!"

"Yes …"

"Then why do you keep him around?"

“What if I had a Science Advisor who knew what he was doing? Then I would have another person pushing me to do something. He doesn’t push. He is a 9 to 5 man who is only interested in his pay check. Besides …” The President paused while he took a sip from his martini.

“Besides what Mr. President?”

“The press has already figured out he doesn’t know what he is doing. It’s only a matter of time before they will check around, find out he *grifted* at M.I.T. and they hounded him out of his job. This will buy us a few weeks to get our act together ….“

“Oh my …” even the Vice President was surprised at the President’s candor.

“This is how you play the game of politics … or haven’t you learned this already?” The President smirked. “In the meantime you and I need to sort out a plan of action about the *string of pearl* matter.”

The Vice President felt bold. “Can I make a suggestion … Bob …”

She cut her some slack. “If you must … Cheryl …”

“Let us invite the young man who discovered the *string of pearls*, Dr. Thomas Tipler, to visit the Oval Office.”

“My thoughts exactly … can you arrange this for Monday or Tuesday this week?”

“Me?” She replied

He nodded. “Another thing Cheryl … as VP Space Policy is your bailiwick isn’t it?”

“Yes …”

“Well … from this moment onwards the *string of pearls* is officially a space matter. From this moment you are the point for my Administration on this matter.”

She smiled like a Cheshire Cat. “And what about your White House Science Advisor?”

The President waved his hand as dismissal. “Send him out of town on some silly errand … say south to look into that boll weevil matter in Alabama … the press will read between the lines.”

There was a knock at the door and Jim entered with the tray of hors d'oeuvres. The President nodded a thanks to Jim and after his valet left got up out of his chair and lifted the telephone receiver out of its cradle. He spoke into the receiver. “The Vice President wants to make a telephone call …”

She got out of her chair, leaving her empty martini glass on the coffee table, walked over to the telephone where the President handed her the receiver. He could smell the alcohol on her breath.

She spoke into the telephone. “I would like to speak to Dr. Thomas Tipler … yes the astrophysicist. I will wait on the line as you ring him up.”

The President grabbed his martini in one hand and a hors d'oeuvres in the other and sat back into his chair. She had her back turned to him. He admired her form. For a forty five year old career woman her figure was still there under the boring grey and blue business suit.

The President closed his eyes, munched on his favorite hors d'oeuvre, sipped on his cold martini and listened in as his VP invited Dr. Thomas Tipler to the White House.

Isn't it great that he had a job that let him tell other people what to do and knew they would do it! He looked around the room and wonder what he might do after he left the White House.

After all where can you go and what can you do after being President of the United States?

Chapter 13 – Neutrinos!

Figure they would have his office in the sub-basement, beneath the actual basement. Traditionally that is where nuclear physicists and astrophysicists are hidden away … out of sight and out of mind. Yet even deep within the bowels of the physics building at Tokyo University he could sense the tremors of the busy city without.

His post-doc research had been on neutrinos from aneutronic fusion reactions. His specialty was the deuterium related fusion reactions such as deuterium and Lihiutm-6. As neutrinos detectors became more sensitive the threshold for neutrino energy detection had reached below 150 keV.

As a sideline to his main area of research, he had written several algorithms to mine the humongous sets of neutrino data from the Super-Kamiokande neutrino observatory as well as from the SNO and Borexino neutrino observatories. The algorithms had run unattended for months and months looking for continued steady near sources and stationary positions. Unlike astrophysicists looking for nova or supernova events, which provide pulses of neutrinos, such as in supernova 1987A, he was searching for the first sign of a steady source of fusion neutrinos from outside our solar system.

When he first detected a near source from the Super-Kamiokande neutrino data only a few thousand A.U. away from Earth he had dismissed the event set as a glitch in the SK data. However, when similar results were found in both the SNO and

Borexino neutrino data he began to accept the detection as real. Sure it was only a handful of neutrinos every two or three months, but what caught his eye was that the neutrinos consistently had an energy of around 0.86 MeV which indicated they were from neutrinos from the conversion of beryllium-7 into lithium-7.

The Cherenkov cones from the neutrino events in the detectors were not all that good at resolving a direction to such a weak source so close in and so he was frustrated until he could analyze more events. So he ran a rolling filter on the past data and asked whether the Super-Kamiokande neutrino observatory might help out in resolving the source by gathering new data for this source.

A week after he put out the call, it was one of the Super-Kamiokande researchers who came to see him unannounced early one morning in his office deep within the sub-basement. He had one and only one question …Why? … So he patiently and carefully explained that he was looking for the position for a close in astrophysical fusion source.

“How close in?”

“Perhaps 2,000 to 2,500 A.U.”

“That close! Is that possible?”

"Yes … with a dwarf star."

"But astronomers have not found such a thing so close to Earth."

"Not yet … but the source I have been tracking appears to be close to Earth, somewhere in the Oort Cloud."

With the mention of the Oort Cloud his visitor suddenly flared his nostrils and then slowly took a USB stick out of his shirt pocket. He handed over the USB stick.

"What is this?"

"This is the full data set for you're an anomalous source. We were embarrassed … for the past few years we have thought it was a glitch in our detector and so we washed it out of the full data set." His visitor sat quietly as he first downloaded and then started to analyze the additional data. After a few minutes he returned the USB stick to the visitor who then quietly left his card at the corner of his desk left.

He was happy he was now alone for the additional data on the USB stick was incredible. His algorithms ran through the 177, 385 additional events in under twenty minutes and then plotted them in a series of histograms that narrowed the source distance to 2172 A.U. and a location that was moving slowly on a circular trajectory perpendicular to the ecliptic.

When he was finished he sat in astonishment of the ramifications of this revelation. There was a neutrino source in a close in orbit around the Sun! He turned to his desk and lifted the receiver and dialed zero. Excitedly he spoke to the operator and put in a long distance telephone call.

It was early morning in Tokyo and it was evening of the night before at the other end of the telephone. A tired voice answered at the other end.

He spoke in his broken high school English introducing himself and enthusiastically explaining what his analysis indicated. The voice on the other end of the line cheered up, asked him some specific astrophysics questions and then gave him his email T.Tipler @ astrophysicsinstitute.org.

Within a few minutes the entire neutrino dataset for the anomalous source at 2172 A.U. as well as the histograms for 212, 731 events were half way around the world.

The email back had just three letters … WOW!

Chapter 14 – No Mr. President!

Thomas was surprised when he got the telephone call from the Vice President inviting him to the White House. He was twice as surprised when he asked her whether he could come with his mother and a friend and she said yes.

A few minutes later there was a second telephone call from Dr. Aristo asking whether he needed anything form her or the Astrophysics Institute for his briefing of the President.

“Briefing?” he asked her.

“Yes, briefing …. Don’t you know this is why they want you to visit the White House. They want you to brief the President and some of his key advisors about the *string of pearls*.” Dr. Aristo took the edge off her words as she said them. She was upset that they had not thought of asking her to do the briefing because after all she was the director of the Astrophysics Institute.

Thomas literally felt his feet grow cold as his circulation slowed as Dr. Aristo said ‘They want you to brief the President.’ Being essentially fearless, his cold feet was an odd feeling he had never felt before. But he knew he was going into shock.

“Thomas … are you ok?”

"Not really … I don't know if I can do this!"

"Sure you can … do you need some help? Do you want me to come help?"

There was an awkward pause then Thomas asked "would you like to go and brief the President."

"You mean alone?"

"Yes."

"No … they want you to come to the White House. If they wanted me to brief the President they would have asked me!"

Again there was an awkward pause.

After a good fifteen seconds she spoke up. "If you want me to come and help then I will but no, you are who they want to meet and talk with. After all it is your discovery, and I can't think of anyone who knows more about the *string of pearls* than you do."

Thomas decided on a change of tack. "Have you heard the latest about the neutrinos?"

"I have. Wow what a revelation! It was wonderful the Japanese nuclear astrophysicist knew to contact you directly."

"Do you think I should tell the President?" Thomas asked.

"That's a tough question isn't it? From an astrophysics point of view this is a remarkable revelation however his national security people may have a different take on this. Neutrinos mean nuclear and well … the last thing we want is a bunch of brass hats running around in circles yelling nuclear …"

"Brass hats?"

"Generals and Admirals … the military Thomas. Fortunate for us The President doesn't think much of Brass Hats …"

"And what about the Vice President?" Thomas asked Dr. Aristo.

"Well that's a different story. She's a former Naval Aviator …"

“She flew F-18’s didn’t she?”

“Yes … she retired as a naval Captain from the US Navy.”

“How do you think she will react to hearing the central feature is emitting neutrinos?”

“Publicly I don’t know … But I suspect she will react privately. Besides they probably already know.”

“Already? How, the Japanese astrophysicist said he would keep it under his hat. I have another call scheduled for tomorrow with him. I guess I should reschedule the call.”

“Come on Thomas … you are not speaking on a secure telephone and so anything you say is probably being monitored, if not by the alphabet soup crowd then by the press.” Dr. Aristo was surprised that Thomas had not thought this matter through.

“Alphabet soup?” asked perplexed.

"I will let you figure that one out."

"And the press …"

"Come on Thomas, to get a good story the press will stop at nothing, so be careful what you say and who you say it to. Your *string of pearls* is front page news for God's sake!"

"Do you want me to come?" Dr. Aristo asked.

"Sure if they let you. I said my mother wants to come and meet the President."

"I don't think they will let your mother sit in at the briefing …" she stated.

"Then I guess you will have to mother me," Thomas joked.

"Ha ha ha Thomas. You can do this. I will only come to provide you scientific support …"

There was a double beep on his cellphone. "There is another call … let me put you on hold for a second." He transferred over.

“Hello?”

“This is the White House Operator, standby for the President of the United States …”

Before he could register this thought there was a familiar voice bellowing over his cell phone. “Thomas this is the President …”

“He … he .. hello Mr. President.”

“Nervous are you Thomas.”

“Yes ….”

“Don’t be this is a just a short and a casual call.”

“I see …”

“Are you looking forward to visiting the White House?”

“No Mr. President!”

“No!”

“No … I would rather not.”

“Why Thomas … I have heard some wonderful things about you, about how you work and about your discovery.”

“I don’t like publicity Mr. President.”

“You’ll get used to it and really fast I imagine. I hear they want to put you on the front cover of Time Magazine and even make you their Man of the Year …”

“That’s an honor I could do without!”

“Nervous are you?”

“To be perfectly honest …”

“Yes, please do … I appreciate honesty!”

“I would rather stay out of the publicity and just focus on the science.”

“Admirable Thomas, simply admirable … but whether you like it or not you are now a public figure and are working on a public issue that affects all of mankind! It being about extraterrestrial life and all …LGM”

“LGM” Thomas asked the President even though he knew what it meant.

“Little green men … don’ they teach you anything in science class?”

“Other things Mr. President, they teach us lots of other things, but not about LGM …

“I hear your mother is coming with you. How you getting to the White House?”

Thomas suddenly felt small and vulnerable. He needed to push back. “May I bring Dr. Aristo too?”

“Sure, I met he once at a conference many years ago. Say hello from me and tell her she is welcome to come.”

“May I put you on hold for a few seconds, she is on the other line and I have her on hold.”

“Sure Thomas … for you I will hold.” The President was enjoying the openness of the young astrophysicist.

Thomas switched to the other line. “Dr. Aristo … you still there?”

“Yes Thomas … You sound excited. what’s up?”

“You’ll never guess who is on the other line?”

“The President?”

“How did you know?”

“I have been waiting for seven or eight minutes. It has to be someone important.”

“He says hello.”

“Does he! It’s a wonder he still remembers.”

"Remembers?"

"That's a story for later. Tell him hello from me."

"I will and guess what!"

"He wants me to come to the White House with you?"

"Yes … you're batting a thousand …"

"Sure, I will come, if only to mother you. I will get off the line now. Call me later."

"I will call you right back after my call is over with the President."

"Ok." Her line went dead and Thomas transferred back over.

"Dr. Aristo says hello Mr. President and yes, she will come to the White House with me."

“That’s great Thomas. That might take the edge off your nervousness.”

“No Mr. President it won’t.”

“That’s the second time you have said no to me … I am not used to people saying no to me, not even my wife …” The President let out a guffaw.

“Tell me Mr. President what kind of briefing will I be making? Is it an informal one or a formal one?”

“There will be me and a few of my colleagues there. It will be in the cabinet room and afterwards we shall go to the Oval office for some pictures. The press will want pictures.”

“I sure they will,” Thomas said with much enthusiasm.

“Relax my boy, it will be a marvelous day for you and a marvelous day for me, and people will finally get some answers to their questions …”

“I hope I have answers to give.” Thomas said sternly

"What do you mean Thomas?"

"I don't like to speculate …"

"*Hypothese non fingo* ehhh!"

"yes … *Hypothese non fingo."*

"Good man … they told me you are like that … Good man!"

Thomas finally felt his feet grow warmer. "Yes Mr. President!"

"That's much better Thomas. See you tomorrow. Get a good night sleep we have a lot of work to do together tomorrow you and I."

"Yes Mr. President." The line went dead. Thomas sat there staring at the telephone receiver trying to process sin his mind the nuances of his conversation with the President of the United States.

He smiled … the *string of pearls* does indeed affect all of humanity.

Chapter 15 – A Much Closer Look

After his return from Washington Thomas all but took up residence at the control room at the Astrophysical Institute, never once venturing out during the day to avoid the throng of journalists and *looky-loos* keen to meet him now that he was a celebrity.

He did venture out once or twice in the wee hours of the morning to go home, say hello to his mom, grab a suitcase of fresh clothes and leave his dirty laundry to be looked after. He hated all his celebrity status and regrets agreeing to meet the President. On the morning they were to go to the White House at the last minute his mother got cold feet and stayed home. Dr. Aristo ended up mothering him after all.

The briefing had been a long and problematic one. Every seat at and around the large oval table in the White House was occupied when he and Dr. Aristo gave their briefing to the President. Absent was his Chief Science Advisor who was away on an important visit to Alabama. The most difficult questions came from the Vice President who was persistent like a bull dog barking for its bone. Sometimes Dr. Aristo would answer her questions, and sometimes even the Director of NASA, but time and time again the Vice President would turn to Thomas and ask him direct questions. He tried to give her direct answers, but in the score card of the afternoon there were far more unanswered questions than answered ones. He had to remind everyone in the room that in science this is how things are to begin with when you encounter a new phenomenon. This appreciation fell on deaf ears.

What was ominous was that the Secretary of Defense stayed quiet for most of the briefing only asking the occasional question that related to perceived threat assessments. He got particularly upset when Thomas stated that the *string of pearls* appears to have been in its present orbit for many hundreds of thousands of years.

After the briefing the President, Vice President, Thomas and Dr. Aristo ventured into the oval office for tea and biscuits. The conversation was casual and inconsequential. Then the Vice President asked Dr. Aristo to join her in the cabinet room for a few minutes. When the VP opened the door the official White House photographer and Press Secretary stepped in and there was a short and formal picture taking session with the President within the Oval Office. Thomas had been insistent that he did not want to face the press directly. The Press Secretary read out the official communique that was to be released about Thomas' visit.

The President shook Thomas' hand and said "you did a wonderful job today in your briefing."

"Thank you Mr. President. Can I ask you something?" Thomas was deferential.

"Yes … and if I can answer your question I will." The President answered equally deferentially.

Thomas felt bold. "What do the Generals think about the *string of pearls*?"

The effect on the demeanor of the President was immediate. “That is a very good question Thomas!” For a half minute the President lowered his head and stared to the right. Then he looked Thomas directly in the eye and began to speak slowly and deliberately. “There are divided sentiments among the Generals. Some are preparing elaborate war plans … and some are just standing by waiting to see how this matter transpires.”

Thomas scratched his head. “Don’t they realize that the *string of pearls* has been in orbit around the sun for eons … and yet we are still here, as far as we know untouched by whomever or whatever the *string of pearls* represent?”

“You made that quite clear during your briefing. I only hope this sinks in with the Generals. You have to understand one thing Thomas …”

“What is that Mr. President?” Thomas asked.

“The Generals’ job is to protect us from threats foreign and domestic. But you need not worry too much Thomas.”

“I do worry Mr. President!”

”Don’t worry Thomas. I am in charge here. I am of the opinion that we should keep an open mind and try to learn more about this phenomenon … before we make any drastic and irreversible decisions.”

“And your Vice President, what about her?”

“You know the game good cop bad cop?” Thomas nodded. “She is playing the role of bad cop because I asked her to. This means we can cover all bases in our considerations.”

“I see … and how is the good cop doing?”

“People fear what they don’t understand. I have the job of being the optimist to try to keep the public from letting their fears run away with them.”

Thomas smiled.

“Thomas, I might have some more questions for you.”

“I thought you might. Can we talk over the phone or have a video meeting. It’s a bit of a chore for me to come to the White House.”

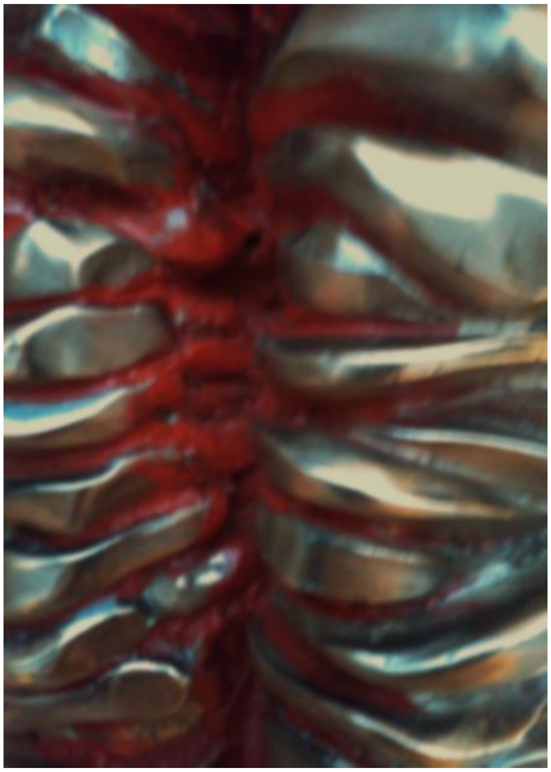
The President nodded. “In the way of appreciation for the two of you coming to brief me here today I have made arrangement for your and Dr. Aristo’s to return home in style.” He opened the curtains behind his desk in the oval office and smiled. It was at the President’s insistence that they would take a ride home on *Marine One*, the Presidents helicopter.

The flight home was a thrilling cap to an interesting day. His mother was so amused to first hear the thump wump thump of *Marine One* and then rush out the front door to see her son and Dr. Aristo saluted as they disembark on the street in front of their home from the President’s private helicopter. Their neighbors who had watched him grow up gathered quickly gathered on their front lawns to applaud Thomas as he disembarked from *Marine One*.

That night his mother organize for Thomas and their neighbors an impromptu BBQ to welcome him home from the White House. Halfway through the BBQ the President gave a speech to the nation from his desk at the Oval Office thanking Thomas for his briefing about the *string of pearls* and assuring the nation that the best scientific minds were hard at work trying to decipher the meaning and implications of the *string of pearls*. In his speech to the nation the President repeated publicly what he had stated to Thomas … “*I am of the opinion that we should keep an open mind and try to learn more about this phenomenon ... before we make any drastic and irreversible decisions.*” That night Thomas slept like a baby.

Ten days after Thomas' visit to the White House the SoPBSI-1 spacecraft did a proximity fly-by of the central feature of the *string of pearls*. The spacecraft's closest distance of approach was 250,000 km.

In the final hours to point of closest approach the pixels on the six very high resolution multispectral camera began to register patterns of remarkable complexity on the central feature.



The central feature was convoluted and appeared to have a metallic gold finish. Deep within the trough of the central feature infrared light was leaking out. At a distance the central feature appeared nearly the temperature of the surrounding space however the closer you got to its surface the higher temperature registered by the instruments on the space craft. Extrapolating inwards it appeared inside the central feature was a thermal source with a temperature of around 1,350 K.

The other six objects leading and trailing the central feature appeared to be perfectly spherical and perfectly smooth and devoid of any structure what so ever. This presented a paradox for the simple impact of asteroidal objects in the Oort cloud should have been registered on their surface. But they were perfectly smoothed despite the fact that they were quite old.

The overall large scale pattern on the central feature were definitely Hilbert fractals but as the resolution improved layer upon layer of added topographies came into view. The surface of the feature appeared convoluted almost as if it were folded repeatedly inwards on itself. The peaks registered at an apparent temperature of deep space while the crevices began to register fluctuating temperatures many hundreds of degrees above absolute zero. The crevices were engineered to hide the true temperature of the central feature in the string of pearls while the peaks represented many tens of thousands of times the area of the crevices.

From his seat at the back of the control room Thomas did a rough calculation and realized that the convolutions were meant to hide the true temperature of the central feature. The convoluted surface was a way of hiding the fact that inside the central feature was a dwarf star nearly 35 times the mass of Jupiter. It struck Thomas immediately how clever was the design of the central feature.

He turned to his colleague sitting at his left and whispered “Dr. Aristo … I think the central feature is a Dyson Sphere.”

Even in the darkness of the control room Thomas could sense Dr. Aristo’s mystification so he repeated what he had just said … this time a bit louder to make sure she heard him.

“Dr. Aristo , I think the central feature is a Dyson Sphere.”

The effect on Dr. Aristo of these words was totally unexpected.

Chapter 16 – Now What?

“Shhh …” Dr. Aristo grabbed Thomas by the arm and all but dragged him out of his chair and then up the aisle and out of the control room. “Not in here … they will overhear!”

Thomas was startled but did not stop her. Thomas knew he did not know much about social graces. Socializing was not his forte by far. When he was young his mother would sometimes also grab him by the arm and usher him away from harm’s way or to keep him from embarrassing himself.

Thomas took Dr. Aristo’s insistence in good stride.

“Your office or mine?” she asked him.

“Yours …” he said befuddled.

As they glided past her secretary Penny looked up with concern as Thomas flew by being dragged by the arm by Dr. Aristo. Penny noticed the determined look on Dr. Aristo’s face. Thomas gave her the ok sign with his free hand.

Before she closed her door Dr. Aristo asked her secretary to arrange for dinner. Then she slowly and deliberately closed the door and then leaned her head against the hard wood paneling of the door. “I am glad I caught you before you let everyone in the room in on your hypothesis …”

“Hypothesis?” Thomas wondered.

“Yes … hypothesis.” She pushed herself away from the door and turned dramatically and then said “I thought you did not make hypothesis Thomas.

“I don’t … I meant what I just said … the central feature appears to be a Dyson Sphere!”

“But how can that be? It would take the entire volume of an earth sized planet to make a Dyson Sphere.” Dr. Aristo walked across the room and stood behind her desk next to her chair.

“Perhaps a bit more than an Earth sized planet if it was made of rigid materials and considerably less if it was not … but I am beginning to suspect it is not a rigid structure.”

She tumbled into her chair. “This is some sort of joke of yours Thomas, isn’t it?” She spoke seriously.

“Joke? No I am entirely serious.” Thomas paused a few seconds expecting Dr. Aristo to interject. When she didn’t he continued. “The central feature of the *string of pearls* is not merely a Dyson Sphere but I believe it has the characteristics of a stellar engine ...”

“A stellar engine! Are you telling me that entire structure comes from somewhere else in our galaxy?”

“Yes … I think it does. And I am beginning to doubt it is made of solid materials. I think it is perhaps made of something microscopically thin.”

“If I did not know you as well as I do I would think you are crazy … A Dyson Sphere … a stellar engine!”

“Yes, a stellar engine. The mass in the other six features might be the mechanism by which the motion of the stellar engine can be been controlled. Look at where the masses are presently. Three leading the orbit of the central feature and three trailing the orbit of the central feature. That’s a stable configuration.”

Dr. Aristo pointed to the white board on the wall next to her desk. Thomas walked over and picked up a blue marker. He quickly sketched the seven features of the *string of pearls* as they presently appeared and then drew a second diagram with the seven features in a V-shape with the central feature trailing the other six pearls. “The stellar motor might function simply by mass asymmetry. The six masses when set in front of the central feature accelerates the system forward. The six masses when set behind of the central feature decelerates the system backwards. The six masses configured as they presently are is a neutral configuration, neither accelerating nor decelerating the *string of pearls*.”

“Oh my … it looks so simple, yet the whole structure is humongous built on a planetary scale.” Dr. Aristo remained skeptical.

“Yes … it probably took many millennium to build it … by whom and for what purpose I presently am not willing to hypothesize!” Thomas stood staring at the board as he said this. He had his back turned to Dr. Aristo.

“Do you think it is inhabited?” Dr. Aristo asked.

“It might be today or it could have been sometime in the past. After all, it has been in orbit around the sun for at least several Billion years.”

Dr. Aristo was about to ask another question when there was a quiet knock on the door. The door slowly opened and in came Dr. Aristo’s secretary pushing a cart with their dinners. “Sorry director … just ham and cheese sandwiches, some fruit salad and coffee. The cafeteria was just closing …”

“That’s fine Penny …” Dr. Aristo nodded.

Penny smiled at Thomas, and he smiled back. “Thanks for bringing us our dinner.”

“You are very welcome Dr. Tipler.” Penny said courteously.

Dr. Aristo said to her secretary, “you can be on your way home now Penny, it is well past six.”

“I might work a little longer. I have some filing to do.” Penny slowly closed the door behind herself once again leaving the two to their conference.

Thomas turned to face Dr. Aristo. “Is it still inhabited you ask?” Thomas had been waiting many months for her to ask this obvious question. “The real question is how can we find this out? … and what happens if it is?”

Dr. Aristo picked up a sandwich took a bite, chewed and swallowed then said “I think the question how to find out we are more than qualified to answer. Perhaps we should attempt a landing with SoPBSI-8 or 9?”

Thomas nodded. He walked over to the cart and picked up a sandwich and started to eat it.

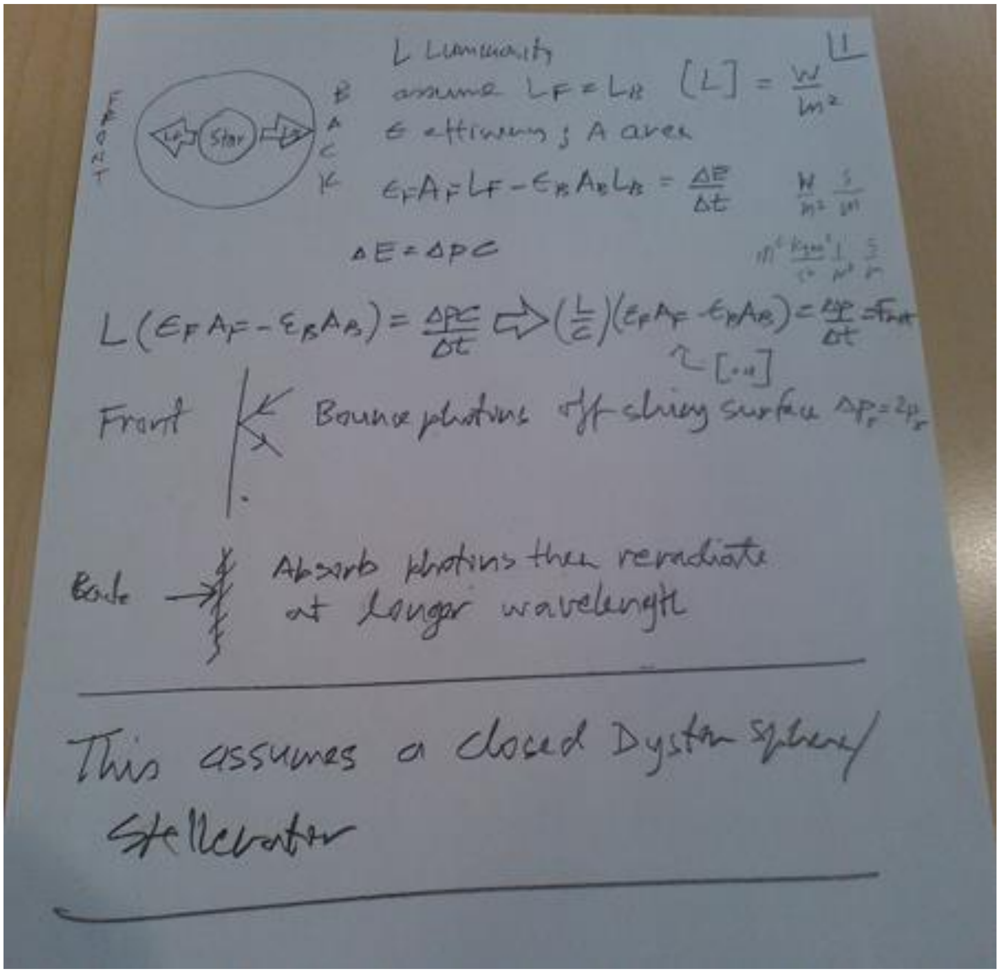
Dr. Aristo poured herself a cup of coffee and walked to her chair with it and sat. “But the questions relating to *First Contact* and what happens then … that has broader and more profound implications.”

Thomas walked to the board and drew a giant question mark beside his drawings. Then he sat next to the cart and just enjoyed his dinner.

The pondering of what happens then would have to wait until after he had his dessert. But his mind keep on the question of the stellar engine. He had read most of the public materials on Dyson Spheres and was familiar with their basic structure. They would have to be rigid if they were being used merely to harvest a sun’s luminous output. But the *string of pearls* seemed to serve a different purpose.

Sure, Thomas was prepared to accept that some of the thermal energy of the star that is inside the structure was harvested to generate electricity, but perhaps most of its luminous energy was designed to be used to move from the *string of pearls* from one place to another.

The thought suddenly dawned on him how to sort out the basic physics of the structure. He absent mindedly got up took a pencil and paper off Dr. Aristo's desk and began to set down his thoughts on paper. In an hour he had finished.


FRONT
BACK
Star
L_F
L_B
1

L Luminosity

assume $L_F = L_B$ $\quad [L] = \frac{W}{m^2}$

ε efficiency ; A area

$\epsilon_F A_F L_F - \epsilon_B A_B L_B = \frac{\Delta E}{\Delta t}$ $\quad \frac{W}{m^2} \frac{s}{m}$

[illegible]

$\Delta E = \Delta p c$

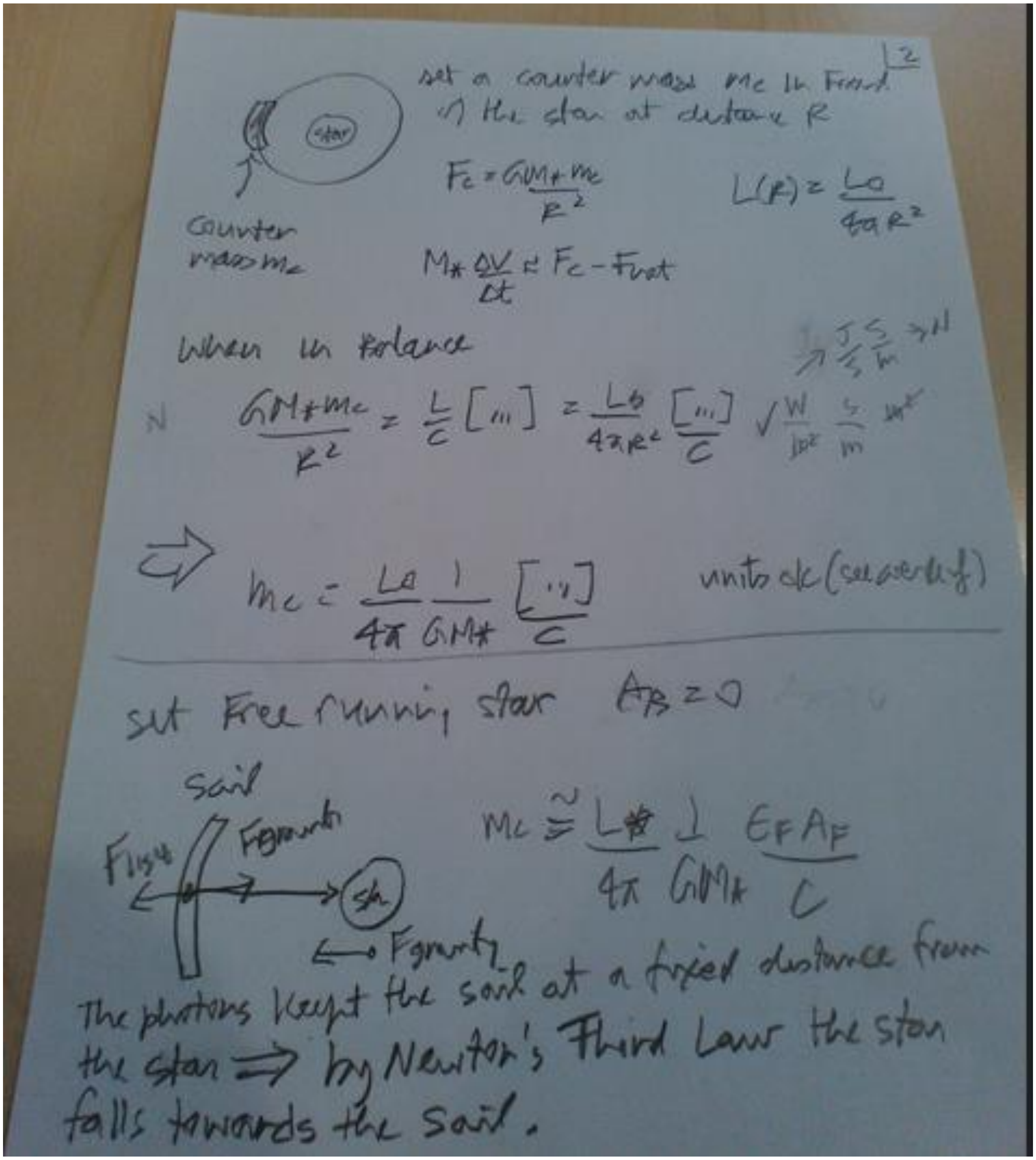
$L(\epsilon_F A_F - \epsilon_B A_B) = \frac{\Delta p c}{\Delta t} \Rightarrow \left(\frac{L}{c}\right)(\epsilon_F A_F - \epsilon_B A_B) = \frac{\Delta p}{\Delta t} = F_{net}$

[..]

Front Bounce photons off shiny surface $\Delta p_r = 2p_r$

Back Absorb photons then reradiate at longer wavelength

This assumes a closed Dyson sphere/ Stellerator



2

set a counter mass m_c in front of the star at distance R

star

counter mass m_c

$F_c = \frac{GM_* m_c}{R^2}$ $L(R) = \frac{L_0}{4\pi R^2}$

$M_* \frac{\Delta V}{\Delta t} \approx F_c - F_{rad}$

When in balance

$\rightarrow \frac{J}{s}\frac{s}{m} \rightarrow N$

N $\frac{GM_* m_c}{R^2} = \frac{L}{c}[\ldots] = \frac{L_0}{4\pi R^2}\frac{[\ldots]}{c}$ ✓ $\frac{W}{m^2}\frac{s}{m}$ m^2

$\Rightarrow$ $m_c = \frac{L_0}{4\pi}\frac{1}{GM_*}\frac{[\ldots]}{c}$ units ok (see overleaf)

---

set free running star $A_B = 0$

Sail

Flight

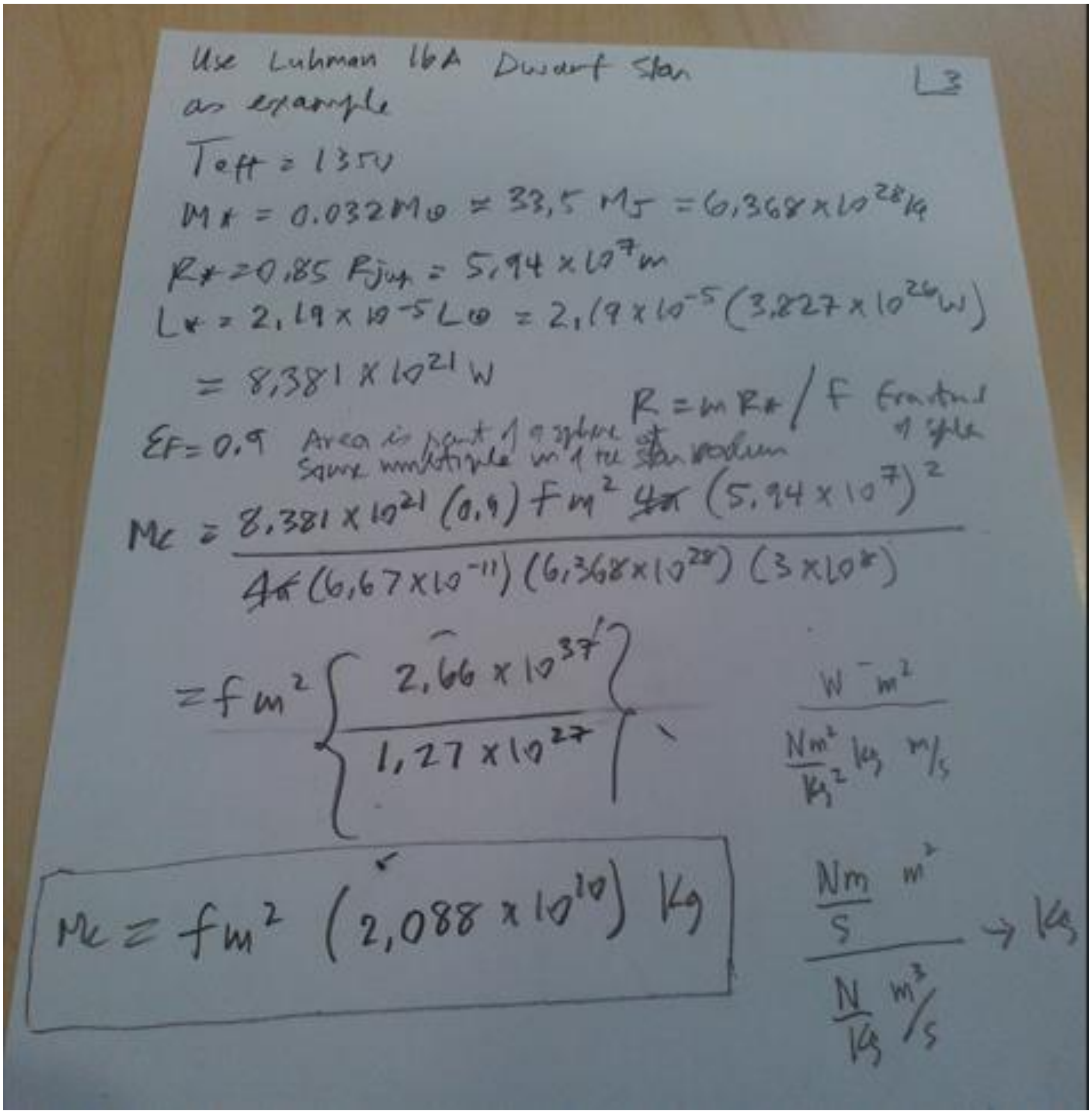
Fgravity

star

Fgravity

$m_c \cong \frac{L_*}{4\pi}\frac{1}{GM_*}\frac{\epsilon_F A_F}{c}$

The photons keept the sail at a fixed distance from the star $\Rightarrow$ by Newton's Third Law the star falls towards the sail.



Use Luhman 16A Dwarf Star as example

L3

$T_{eff} = 1350$

$M_* = 0.032 M_\odot \approx 33,5\ M_J = 6,368 \times 10^{28}$ kg

$R_* = 0,85\ R_{jup} = 5,94 \times 10^{7}$ m

$L_* = 2,19 \times 10^{-5} L_\odot = 2,19 \times 10^{-5}(3,827 \times 10^{26}$ W$)$

$= 8,381 \times 10^{21}$ W

$R = m R_* / f$ fraction of sphere

$\varepsilon_F = 0,9$ Area is part of a sphere at same multiple m of the star radius

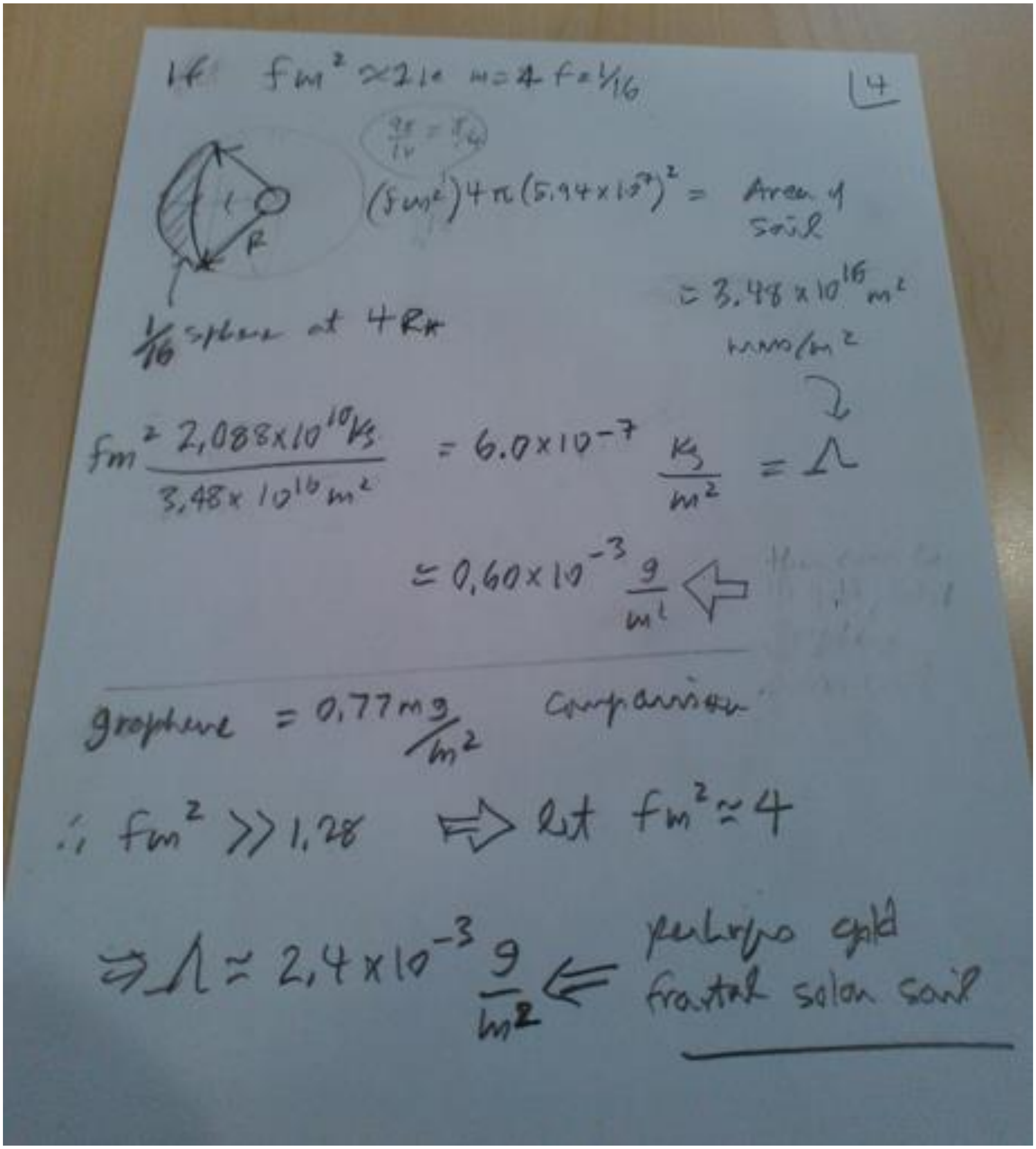
$$Mc = \frac{8,381 \times 10^{21}(0,9) f m^2 \cancel{4\pi} (5,94 \times 10^{7})^2}{\cancel{4\pi}(6,67 \times 10^{-11})(6,368 \times 10^{28})(3 \times 10^{8})}$$

$$= f m^2 \left\{ \frac{2,66 \times 10^{37}}{1,27 \times 10^{27}} \right\}$$

$$\frac{W\ m^2}{\frac{Nm^2}{kg^2}\ kg\ m/s}$$

$$\boxed{Mc = f m^2 (2,088 \times 10^{10})\ Kg}$$

$$\frac{\frac{Nm}{s}\ m^2}{\frac{N}{kg}\ m^3/s} \rightarrow kg$$



If $fm^2 \approx 1$ i.e. $m = 4$ $f = 1/16$ 4

$\frac{4\pi}{16} = \frac{\pi}{4}$

$(fm^2) 4\pi (5.94 \times 10^7)^2 =$ Area of soil

$\simeq 3.48 \times 10^{16}\ m^2$

mass/m²

1/16 sphere at $4R_K$

$$fm^2 \frac{2.088 \times 10^{10}\ kg}{3.48 \times 10^{16}\ m^2} = 6.0 \times 10^{-7}\ \frac{kg}{m^2} = \Lambda$$

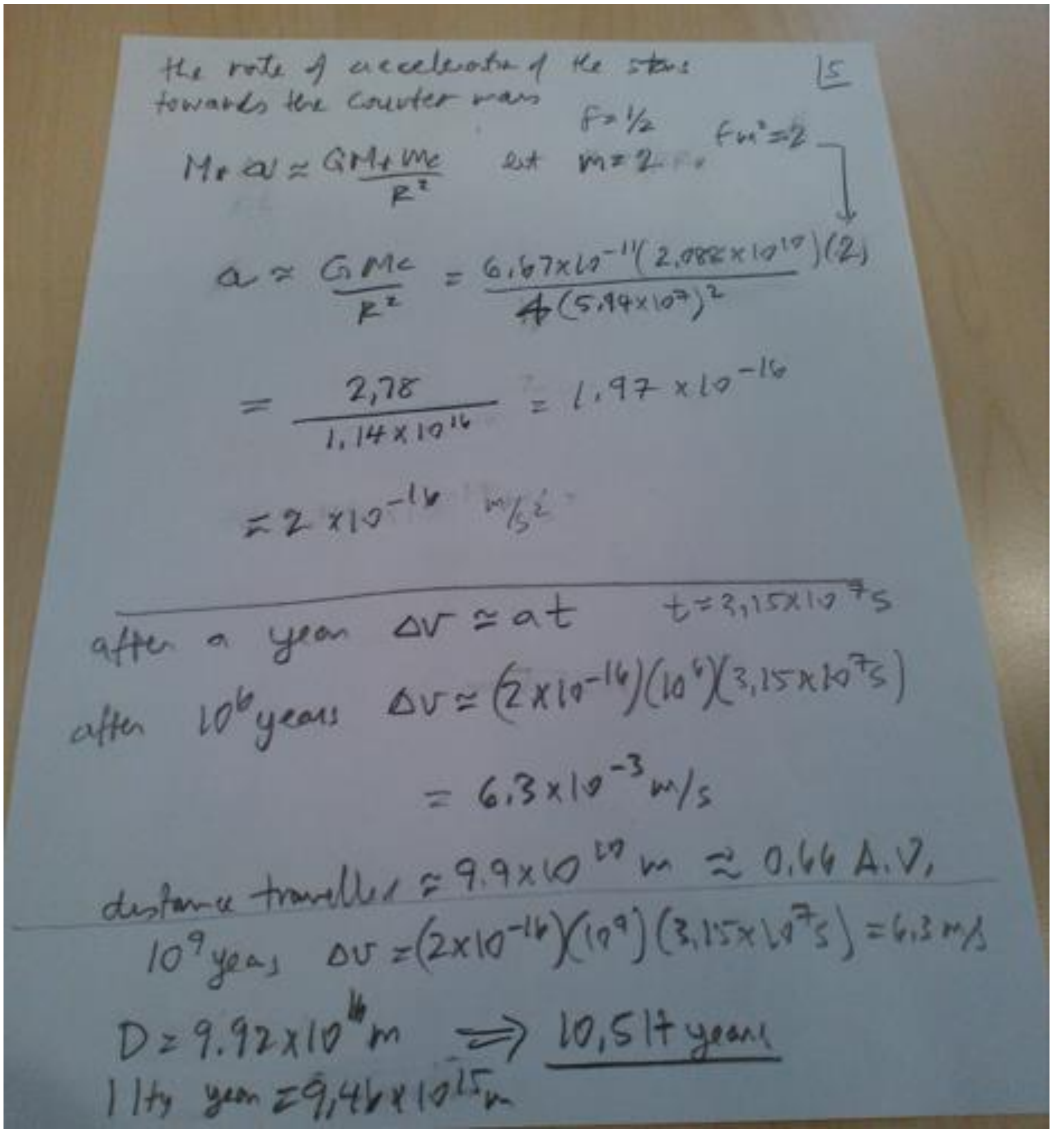
$$\simeq 0.60 \times 10^{-3}\ \frac{g}{m^2} \Leftarrow$$

---

graphene $= 0.77\ mg/m^2$ Comparison

$\therefore fm^2 \gg 1.28 \Rightarrow$ let $fm^2 \simeq 4$

$\Rightarrow \Lambda \simeq 2.4 \times 10^{-3}\ \frac{g}{m^2} \Leftarrow$ perhaps gold fractal solar sail



the rate of acceleration of the stars towards the counter mass

$\boxed{5}$

$f \approx 1/2$ $\quad fm^2 \approx 2$

$M_* a \approx \frac{G M_* M_c}{R^2}$ let $m \approx 2$

$$a \approx \frac{G M_c}{R^2} = \frac{6{,}67\times10^{-11}(2{,}088\times10^{10})(2)}{4(5{,}94\times10^{7})^2}$$

$$= \frac{2{,}78}{1{,}14\times10^{16}} = 1{,}97\times10^{-16}$$

$$\simeq 2\times10^{-16}\ m/s^2$$

after a year $\Delta v \simeq at$ $\quad t \approx 3{,}15\times10^{7}s$

after 10^6 years $\Delta v \simeq (2\times10^{-16})(10^6)(3{,}15\times10^{7}s)$

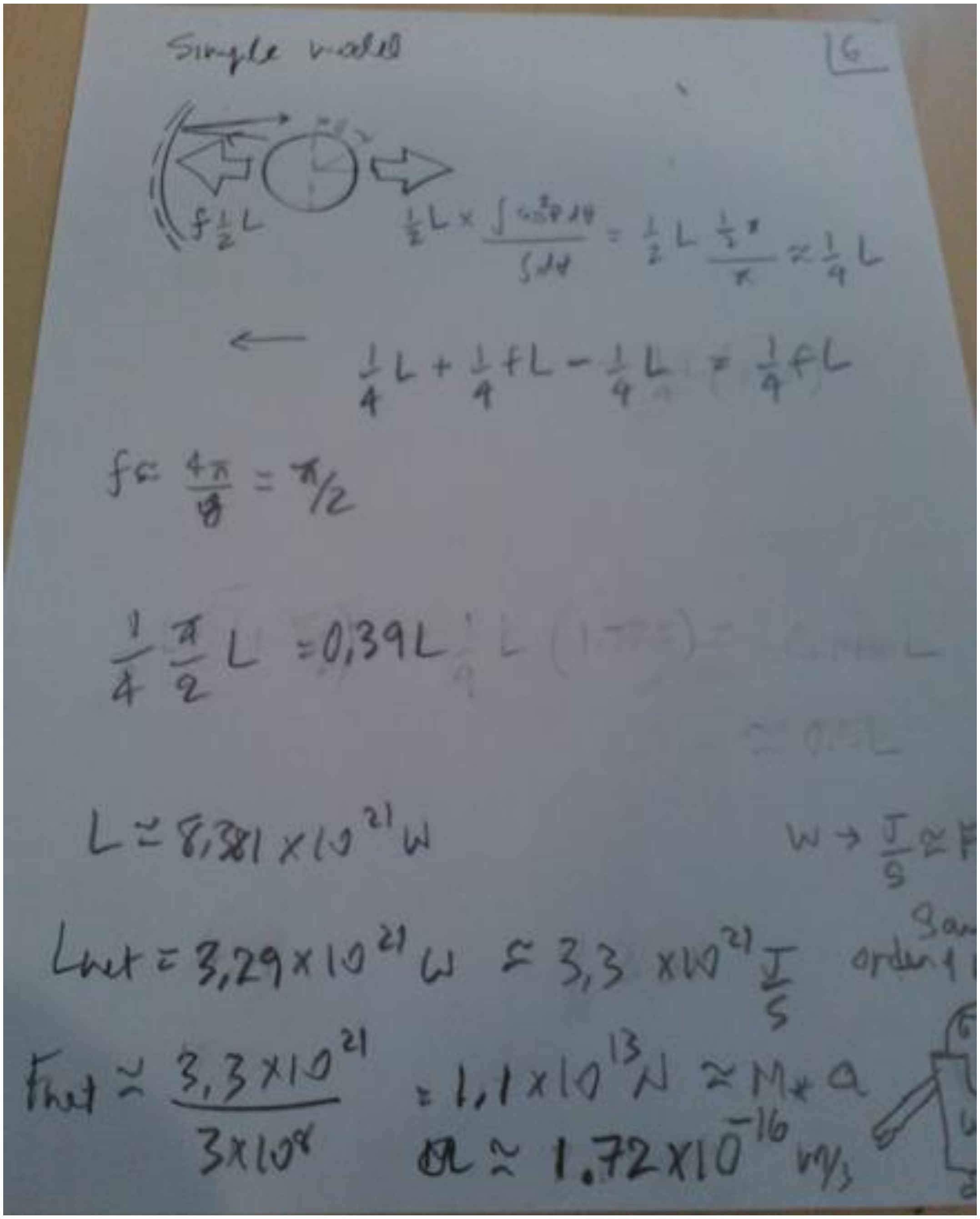
$$= 6{,}3\times10^{-3}\ m/s$$

distance travelled $\approx 9.9\times10^{10}\ m \approx 0.66$ A.U.

10^9 years $\Delta v = (2\times10^{-16})(10^9)(3{,}15\times10^{7}s) = 6{,}3\ m/s$

$D \approx 9.92\times10^{16}\ m \Longrightarrow$ $\underline{10{,}517 \text{ years}}$

1 lty year $\approx 9{,}46\times10^{15}\ m$



Single walled

6

$$\frac{1}{2}L \times \frac{\int \cos^2\theta\, d\theta}{\int d\theta} = \frac{1}{2}L\,\frac{\frac{1}{2}\pi}{\pi} \approx \frac{1}{4}L$$

←

$$\frac{1}{4}L + \frac{1}{4}fL - \frac{1}{4}L = \frac{1}{4}fL$$

$$f \simeq \frac{4\pi}{8} = \pi/2$$

$$\frac{1}{4}\frac{\pi}{2}L \simeq 0{,}39L$$

$$L \simeq 8{,}381 \times 10^{21}\ \mathrm{W}$$

$\mathrm{W} \rightarrow \frac{\mathrm{J}}{\mathrm{s}} \simeq$ F

$$L_{net} = 3{,}29 \times 10^{21}\ \mathrm{W} \simeq 3{,}3 \times 10^{21}\ \frac{\mathrm{J}}{\mathrm{s}}$$

Sam

order

$$F_{net} \simeq \frac{3{,}3 \times 10^{21}}{3 \times 10^{8}} = 1{,}1 \times 10^{13}\ \mathrm{N} \simeq M_{*}\, a$$

$$a \simeq 1.72 \times 10^{-16}\ \mathrm{m/s}$$

Dr. Aristo had patiently paced her office floor as Thomas worked through his calculations. She gave him a Casio calculator without having to ask for it.

In a little under an hour he had finished six detailed pages of calculations.

Thomas gathered up his six pages and turned to Dr. Aristo and handed his calculations to her. “I have assumed a Luhman 16A type Brown Dwarf is inside the central feature. As it so happens a flight profile places the distance the craft has travelled on the order of 5 to 10 light years, depending on the sail energy.”

“Sail?”

“Yes sail. If we accept the notion that the central feature is wrapped by a solar sail, it turns out that Graphene with a gold thread fractal would fit the mass per meter squared parameters of the counter mass.”

“Counter mass?”

“It’s a clever design … at the front of the stellar motor the luminosity impacts the solar sail which because of the photon momentum and energy remains at a fixed distance from the star. There is a counter mass at the front end associated with the solar sail which provides a small gravitational tug to the star drawing it towards the front side of the stellar motor. The acceleration is miniscule but when you integrate the effect over a billion years you can travel upwards of 20 light years. If you assume half the trip is acceleration and the second half of the trip is deceleration than the most probable distance this machine has traveled is perhaps 10 light years!"

"How do we know it travelled for a billion years, Thomas?" Dr. Aristo asked skeptically.

"It's a Bayesian inference. To check this perhaps we can do a Monte Carlo with the key parameters in my stellar motor model … but I doubt the distance will be much different than perhaps 10 to 12 light years. Besides …"

"Besides what Thomas."

"There is the Tau Ceti exoplanetary system with a G8V type star twelve light years from our solar system. It has been around for nearly 10 billion years. We know it has two planets in its habitable zone." Thomas leaned back in his chair and put his hands behind his head.

Dr. Aristo sighed. "So … "

"Ten billion years …" Thomas said emphatically for a G type star!

“Oh! Of course … the star Tau Ceti is nearing the end of its life.” She said.

“Indeed! And if there were a civilization on one or more of the planets …”

“That civilization would want to high tail it from Tau Ceti before went it Super Nova! A dozen light years is not that far from Earth is it? ”

“I would venture into space if I were them.” Thomas muttered. “There is also something else to consider and that is how they are extracting energy from a red dwarf. This would pose an efficiency issue. This also begs the question whether higher forms of life can thrive merely using infrared light. We live around a G type star. Can higher forms of life such as human survive around red dwarfs?”

“Yes … that is an issue.” Dr. Aristo frowned. “I understand that bacteria can thrive under infrared light but oxygen producing plants and animals found on Earth would not, especially higher forms of life. Any suggestions?”

Thomas proffered as a suggestion. “Along with the usual Carnot cycle and turboelectric dynamos, I know you can frequency double using crystals such as making blue green laser light using neodymium crystals. Perhaps something along those lines would be used by higher forms of extraterrestrial life?”

There was a knock on the door, and Penny poked her head in. “I am on my way out. Is there anything you need me to do before I leave?”

Dr. Aristo turned to Thomas and asked. “You look tired Thomas would you like Penny to drive you home?”

All Thomas had to do to say yes was smile. And Penny blushed and smiled back.

“See you first thing tomorrow.” Dr. Aristo ushered the two of them on their way.

“I just need to get my things from my office.” Thomas said.

“I will come with you.” As they walked by her desk Penny picked up her coat things and followed Thomas to his office down the hall.

Chapter 17 – A Shiny Penny

Penny drove a Small red Fiat that looked almost like a Lady Bug. Thomas was not surprised to see this for he had understood from the first moment the two of them had spoken how practical she was. Her father had been a mathematician, which meant she grew up in the shadow of a logical thinker.

Penny wondered what he was thinking as she drove cautiously, more so than usual because she had a passenger and someone she cared for.

For the first few blocks they were both silent. Then she found the courage to ask him how things were going with his *string of pearls* analysis.

He started to speak share with her the analysis he had just completed and then suddenly stopped. "I don't know if I should be telling you this. It's all hush-hush. Can I trust you?"

She looked over at him and giggled, "oh course you can," then quickly look back at the road ahead.

Thomas found this charming and suddenly found the courage to say "you know Penny I like you …"

“You know Thomas, I like you too.”

Once again there was an awkward silence. Then Thomas spoke up. My mother is not expecting me home until late. Would you like to grab dinner?”

“Sure, but only if you let me decide where …”

Thomas gulped wondering if he had enough money in his wallet for dinner for two. He fished his wallet out of his pocket and peered in. Only 35 dollars and change!”

“Relax Thomas we are here.” She pulled up next to the curb at a Park. He looked around. There was not a restaurant in sight. She got out of the Fiat and then leaned down to ask him “are you getting out?” As he glanced over the front of her dress billowed and Penny presented two swells of flesh that defined her bosom. She must have known what she was doing for she leaned even further forward and lifted her purse off the mound between the two front seats, then paused to look over at him and smile playfully.

Thomas felt his face grow warm as he turned to open the passenger door and lift himself out of the Fiat. The moment he was out of the car he could smell the aroma of Frankfurters.

“I hope you like hot dogs!” she sang.

He smiled and nodded.

“I sometimes stop here on the way home from work when I am famished.”

Thomas looked around and spotted a small vendors cart under a bright yellow umbrella.

“It ain’t much … but he sure knows how to make a good hot dog!”

As they approached the hot dog vendor he waved and she waved back. Even from a distance he looked very European, right down to the dark floppy hat he wore.

“Two usuals please,” she said as she slapped a ten dollar bill down on the corner of the vendors cart.

“But Penny, you must let me pay …”

“Maybe next time …”

"How are you today my shiny Penny?" the old man asked her.

"A bit tired …" she replied

The vendor handed her a hot dog with all the works. She looked at it and said "but you have left off the onions …"

"Yes I have," the vendor said, "and later you will thank me. Who is your friend?" the old man asked curiously.

"He is one of the professors at the Institute," she said, without saying his name.

Thomas took that as a queue to introduce himself. As he pressed his hand to shake the vendor's hand, the vendor thrust a hot dog with all the works into Thomas' hand. "That's good there are no onions …" Thomas parroted.

Then the vendor pointed at the ice box with different soda pops and they each picked up one.

He was about to hand her the change when she waved the change aside and the two took their meals and walked towards some park benches a few meters away.

They both sat side by side at the bench. Penny closed the distance so that her thigh nor abutted on his. She was wearing a lovely dress that was short enough to expose her knees as she sat next to him.

“It’s a bit informal …” she said taking a bite out of her hot dog. .

“I don’t mind informal … Penny.” Thomas responded bravely by taking a careful bite out of his hot dog.

“When my mother left us my father had to take up being father and mother to me and my little sister … I have eaten quite a few hot dogs!”

“She left you, your mother?” Thomas asked, his mouth still half full.

“She said it was hard to be married to a mathematician. She felt lonely and so she had an affair and well, got pregnant with the other man’s child. She had to leave.”

“Oh my … sounds dramatic.”

“It was. I was only ten at the time and my little sister six. My little sister cried for months. Me, I decided to dress up and act like a tom boy. I wanted to hide the fact I was a girl.” The moment she said the tom boy thing she regretted it.

“I can’t see you as a tom boy …” said with ketchup and relish oozing out of the corner of his mouth.

Penny giggle and reached over with a serviette to catch the condiments before they fell on his lap.

“Thanks.”

Penny felt a bit of courage come on. “I am still a bit of a tom boy you know …”

“That’s good.” Thomas said sympathetically.

“I wanted you to know this.” Penny said earnestly

“Why do you want me to know this?”

“We’re on a date aren’t we?” Penny whispered.

“I wouldn’t know … I have never been on a date. Is this what a date is all about?” He set his hand with the hot dog onto his lap and looked up into her eyes.

She leaned forward and whispered “I am glad he didn’t put onions in our hot dogs.”

“So am I.” It seemed the natural thing for Thomas to do, so he leaned forward and they kissed.

Chapter 18 – Something Moved!

Thomas and Penny had walked for hours through the park talking about many different things, wandering from one moment in their lives to another. To an outsider observing them, they were obviously in love.

They walked all around the pond at the center of the park noticing a swan with all its seven little cygnets in train. There was one small cygnet that had a hard time keeping up with the rest of the line. The father swan was nowhere to be seen. The littlest cygnet made Thomas think about how he had lived all his life without a father.

Thomas found himself intrigued by the many little stories that Penny shared with him about growing up. Being the eldest daughter of a mathematician who was separated and then divorced meant that she had been drawn into a maternal role by default. She raised her younger sister as best as she could. She also had to look after a father that was anything but organized. He lived inside his mind and ideas and not in the real world. It had been her mother's role to look after the real needs of the family, but she had found this to be too lonely an existence.

Her mother had studied psychology at university and did a post-doc research project on the psychology of mathematicians. This is how Penny's parents first met. He was a brilliant mathematician who had made ground breaking contributions to number theory. She had fallen in love with the mathematician for the wrong reason, and it took her many years to come to terms with this. Then one day she fell in love with another man who was the complete opposite. He drove fast cars and had expensive tastes. They had met at the grocery store. When her car wouldn't start he offered her a lift home with her groceries. They talked as they drove together. She got out of his car all wet and bothered. It was she who gave him her email, not the other way around.

He emailed her a few days later to ask her how she was. When she read his kind email she decided to go out with him and in a few days into their affair she had decided she wanted to start a new family with him. It was the night of their third date that she agreed to share his bed. That night their passion went the full distance.

Two weeks later when she missed her period she knew she was pregnant. Far from being upset she accepted her fate. This would be the break she needed! She did not think of bringing her two daughters with her merely because their mannerisms were more that of their father the mathematician than hers. They were papa's girls. Besides, at thirty three she wanted to make a clean break of things. As Penny told Thomas this story … Penny also told him she understood and accepted all this.

Penny had gotten through high school and university with little interaction with people outside her immediate family. To make matters worse, she took her degree in mathematics in the same Department that saw her father as the head of the Math Department which meant there was even a greater distance between her and her classmates, as well as the professors. She admitted to Thomas that sometimes late at night she would return home from university and cry in loneliness.

Penny had done most of the talking as they walked. But Thomas was a patient man and did not mind this. He knew that Penny was trusting him to understand and that soon he might open up to her about his inner angst, something he had never done ever with his mother.

Then it was time for the two of them to walk back to the park bench they had first sat at. By that late hour the hot dog vendor had folded away his umbrella and had trudged home with his push cart. The sun was just beginning to set when Penny reached over and placed her hand over his. Her hand was very moist and warm. So was his. Then they kissed for a second time, this time Penny initiating the intimacy.

Together, sitting close to each other, Penny and Thomas watched the sun slowly set beneath the distant horizon. Then she drove him home.

The following morning as he arrived at the Institute he found himself a changed man. He had barely slept but felt nonetheless full of youthful vigor. His heart pounded as he approached her. She was wearing a brand new dress, and her smile to him was priceless. She looked like a changed woman, more beautiful than he had ever seen her before.

They both remained silent for want of something meaningful to say.

Dr. Aristo sensed the budding romance between the two of them and grinned as she took Thomas by the arm, whispering to Penny as they walked past “don’t worry … Thomas will be back for lunch.” Penny blushed magnificently.

Dr. Aristo and Thomas stepped into the darken Control Room and sat near the back. The panels were filling with brand new data from the SoPBSI spacecraft.

The fly-by of the central feature of the *string of pearls* had happened so quickly that the data and pictures collected on its close approach had to be archived and then slowly beamed back to Earth. It took over 600 hours to stream the telemetry back to the ground stations – one in the center of North America and the other in the middle of Australia at Alice Springs.

In turn it then took the analysts many dozens of hours of evaluation before the new data began to trickle up onto the big board in the control center at the Institute. A subsidiary feed of vital statistics had been arranged with the White House with Dr. Aristo being in charge of deciding what would be shared outside the institute.

It was agreed – the central feature had a mass of 33.5 Jupiter masses and was hiding away a brown dwarf star. The verdict was still out about the triplets fore and aft of the central feature. They alluded even the most primitive survey. For all intents and measures they were just solid and perfect spheres of materials whose mass was indeterminate given their proximity to the far more massive central feature.

The close up pictures of all seven objects were both magnificent and perplexing. The pictures of the central feature showed great ribbons crisscrossing the sheets of solar sail material. It reminded Thomas of the complex rigging of a grand sail boat his uncle once took him to sea on. When he first went aboard his uncle's yawl he did not know one sail from another, but after sailing from Chesapeake Bay to the Bahamas, once they entered the port of Nassau he was an accomplished sailor.

They did not sail directly from Boston to Nassau mind you, but tacked to and fro in the mid-Atlantic to take advantage of the changing winds of the season to help teach Thomas how to set the sails and how to pilot a yawl in blue water. His uncle was very wealthy and did not have to be anywhere sometime soon. Thomas was told to leave all but one book behind. He took Newton's *Principia Mathematica Philosophae Naturalis*, and read it cover to cover during the epic voyage.

Early one morning, in heavy seas, when he wasn't paying attention he lost his footing and fell over the stern. He went a few meters down and then struggles to the surface. Thomas had just enough strength to swim over to the trailing rope and hang on while his uncle frantically dragged him back aboard. It was only after he was safely on deck that Thomas looked astern and realized that two great white sharks trailing behind the yawl had missed having him for their breakfast by mere meters.

This remembrance of his epic voyage for some reason swam through his mind that morning as he sat in the control room. As he looked up at the slideshow of close up pictures of the *string of pearls* Thomas sensed a similar Geist of a grand voyage of discovery for whomever built this magnificent interstellar craft. The ribbons appeared as ropes to him just as the solar sails appeared as nautical ones. He smiled to himself and thought, were it possible that he might one day meet these brave extraterrestrial voyagers.

Last night, when he couldn’t sleep, he had taken down *Principia* from his book shelf and also opened the picture album of his epic Boston to Nassau voyage. He didn’t know whether it was his romantic feelings towards Penny or the excitement of the latest discoveries about the string of pearls that kept him up last night.

As he sat there looking up at the updates on the great board, all you knew was that something moved deep inside of him.

Chapter 19 – An Annoying Hum …

It was such a subtle effect that it wouldn't have been noticed had Thomas not already known about electromagnetic noise. The SoPBSI spacecraft had neared the end of its 600 hours of telemetry transfer when the spacecraft underwent a programmed 90 degree spin about its axis to improve its transmission quality. In the previous dozen hours of download something was introducing unwanted noise into the digital stream.

The little anomaly was brought up at the end of the weekly meeting, *La Grande Balle*, as they jokingly called the gathering of all participants in the SoPBSI project.

Thomas enjoyed the challenge that an anomaly such as this one had to offer his mind. He enjoyed solving puzzles as much as he enjoyed doing math. His mind was designed for analysis – of patterns, of correlations and of cause and effect.

It was an annoying hum, the likes of which you sometimes hearing coming from high voltage transmission cables if you happen to walk close to the transmission towers. When the few hours of noisy transmission was washed through a *Fourier Sieve* a series of side lobes appeared in the data that was neither due to the spacecraft nor the deep space telemetry stations. It could only have come from somewhere within the *string of pearls*.

The noise had modulation. It had one fundamental frequency and a series of harmonics that descended in an exponential manner in amplitude. Each harmonic had an amplitude of about 0.0471 of the previous harmonic. The modulation did not vary at all during the few hours of noisy transmission.

When La Grande Balle was over and the niceties finished, Thomas walked with Dr. Aristo to the lobby of the Astrophysical Institute while they discussed the Noise Phenomenon.

“What do you think?” she asked Thomas.

“I will have to sleep on it …” Thomas responded.

Something caught her eye outside the Institute. Dr. Aristo looked past Thomas and through the plate glass doors of the front lobby and sure enough, what had caught her eye was the glint off the fender of a small red Fiat. She smiled. “Your ride is here!”

Thomas looked over her shoulder and felt his face suddenly grow hot. “I see that she is.”

“Don’t stay out too late …” she said in a maternal tone.

"Penny is taking me to the driving range. She is going to teach me how to hit a golf ball."

"And what should I say when your mother calls and asks where you are?" Dr. Aristo said in an amusing jest.

"Just tell her I am working late and will be home by eleven."

"Okey-dokey! Have fun!" Dr. Aristo watched as Thomas almost skipped to the Fiat.

Sure, there were some informal rules about how employees at the Institute should conduct themselves during working hours, but short of finding the two of them being crudely mammalian in a broom closet, there was not much Dr. Aristo wanted to do to keep the two of them apart. They were both very happy and Thomas did not seem all that distracted from his research, and beside relaxing the body will help him relax his brain.

Penny greeting Thomas warmly. She wanted to kiss him immediately when he got into her car but Thomas asked her to wait until they were a few blocks away to keep the gossip hounds at bay. Penny complied and then exactly three blocks away she pulled over to the curb and landed a wet kiss on his warm lips.

“Ready to whack a few balls?” she asked him.

“Sure … you’re going to teach me how to do this, right?”

She put the car in gear and pulled away from the curb and accelerated confidently. “Actually I am going to let you try a few hits first to see if you can sort out what are the important things in a good golf swing. Sort of applied physics!”

“You like playing with me don’t you!” Thomas retorted.

“Of course, and I know you like playing with me …” she said gleefully.

Thomas felt his face grown warm.

She looked over at him. “You’re blushing Thomas … we did have fun the other night!”

“It was a wonderful evening. You are very beautiful.” Thomas felt something move within him.

“So are you Thomas … so are you …” Penny felt her hands moisten with sweat and her face grow warm.

Thomas spoke tremulously “Penny …”

Penny smiled. “Yes Thomas …”

“Would you rather we not …” his voice trailed off.

Penny finished his question “… go to the driving range?”

“Yes …” Thomas almost barked the yes out.

Penny lowered her voice and asked seductively,“what would you rather do?”

“Something fun …” Thomas said without hesitation,

Penny decided to tease him a bit. “But whacking a golf ball is fun!”

“Penny … like the fun we had the other day.” He said

"Perhaps …"

Then a quizzical expression came across his face and Thomas looked ahead and went quiet.

"Is anything wrong?" Penny asked.

"One over the square root of 450 is 0.04714045308 …" Thomas said monotonically.

Penny slowed the car and turned to look at him. "Come again, I am not following you."

"We had a *La Grande Balle* today …"

"So I understand … today was my day off."

"And we discussed the noise phenomenon …" Thomas said excitedly.

"And you just figured it out in your head." Penny said with a sight.

Thomas nodded.

“Do you want me to turn back?”

Thomas was about to say yes when he turned to look at Penny and realized that if he said yes she would be profoundly disappointed.

As he looked at her softness came over Thomas’ demeanor. “No … it can wait for tomorrow.”

She smiled at him and then looked back over her left shoulder and seeing the coast was clear may a U-turn into the opposing lane and accelerated madly.

“Yes … Thomas … let us go do something fun together!”

Chapter 20 – Was it Time for Second Contact?

The small and fast moving object had been passively tracked ever since it first appeared as an instantaneous glint in the optical sensors of the active defense system.

The object had been characterized as not being natural but constructed, but since its trajectory did not show it impacting any structure the tracking system remained in passive mode. Had it perceived the object as a threat it would have gone active and either redirected its trajectory or destroyed the object.

The small metallic object was studied intently as it swung by in a close encounter. It was designated as coming from a *Class 4* intelligence. A decision was made not to risk a *Second Contact* at this time and so no active measures were taken.

After it passed the object beamed information back towards the third rocky planet from *Hellas*. The passive system collected, and analyzed the information.

The conclusion was the object was merely a probe and so did not form an immediate threat. There was a healthy discussion and some philosophical disagreements of what might happen next. Some thought perhaps it was time for *Second Contact* …

Chapter 21 - An Unexpected Message.

Suddenly and out of the blue the *Tetrahedral* came alive in the most unexpected manner. A few days after the SoPBSI flyby a single green dot began to appear intermittently on one of the side faces of Dr. Aristo's *Tetrahedral*. It walked across one face then the second and then the third face before returning to its original position and disappearing. After a few minutes it would reappear and do the same dance around the *Tetrahedral*.

Her *Tetrahedral* did that for two days. And for two days she wondered what it meant. Dr. Aristo kept this revelation to herself, but could not hide away her excitement.

On the morning of the third day Thomas was walking down the hallway towards his office when he saw Dr. Aristo and asked her what was up.

"What do you mean?" Dr. Aristo said to Thomas.

"Something is exciting you … I can sense that."

"Really?" She tried to act nonchalant.

"When you get excited you start to speak quickly and in staccato sentences."

“I can’t keep anything from you can I?” She responded.

“No you can’t.” Thomas smirked.

“Follow me then.” Dr. Aristo walked towards her office and past Penny’s empty desk. She read Thomas’ mind. “Penny called this morning and said she wasn’t feeling well. She’s taken the morning off to go to the doctors. ”

When they got into the office Dr. Aristo closed and locked the door behind them and picked up the remote to the big screen monitor she had opposite the white board. She selected channel 7 and up onto the screen appeared her *Tetrahedral*. The face towards the camera was its usual black.

Thomas was surprised. “I had heard rumors you had a *Tetrahedral.”*

Dr. Aristo smiled and then said “just wait a few seconds …” and sure enough the single green dot appeared and walked across the face then around onto the next face.

“Oh my god!” Thomas exclaimed. “I had heard it was inert. When did this start?”

“Two and a half days ago. The dots walks a straight line around the *Tetrahedral* then disappears for a time then returns, cycling through this routine over and over again. We have had it here for several years but this is the first time it has done anything.”

“What about the other *Tetrahedral*?”

“I asked about. Nothing there … this is the only one.”

“Did you do something to trigger it?” Thomas asked?

Dr. Aristo shook her head “not that I know of. I haven’t been to see it in days.”

“Something must have triggered this?” Thomas slowly turned to her and uttered “you know you have never shown me your *Tetrahedral*.”

“I guess now is as good a time as any, follow me.” She led him out of her office down the hall and into the elevator. After the elevator door closed she lifted a necklace from around her neck at the end of which hung a key. She used the key to open a panel at the bottom of the elevator panel and then turned to Thomas and said “you are never to tell anyone about what you are about to see, understand?”

Thomas nodded.

“Do you understand?” Dr. Aristo said.

“Yes …” Thomas looked down and saw a numerical pad behind the small panel.

“Then repeat after me … I will never tell anyone about what I am about to see.” She said sternly.

Thomas repeated back …”I will never tell anyone about what I am about to see.”

“That is a solemn oath, Thomas, that you must never break. Turn around. ”

Thomas turned around and heard Dr. Aristo key in an eleven number code. The lights in the elevator went off and the elevator began to move downwards. When the doors opened there was pitch darkness in the hallway beyond the elevator.

Suddenly a pencil thin light shone in her face and a computer voice spoke “Good Morning Dr. Aristo, what brings you here into the repository?”

“We are here to visit the *Tetrahedral*.” She spoke slowly and solemnly.

"We?" the computer voice inquired.

Again she spoke slowly and solemnly. "I have brought Dr. Thomas Tipler with me this morning. I will vouch for him."

The pencil of light scanned over and then defocused so now Thomas' entire face was visible.

"Turn sideways," the computer voice said and Thomas complied. "Turn face on." Again Thomas complied. "What is your birthday and where do you reside?" Thomas answered the questions.

There was a pause and then the lights flickered on in the corridor, starting at the other end of the hallway. "Proceed," said the computer voice. "I have noticed a change to the *Tetrahedral*. Is this why you are both here?"

"Yes …" responded Dr. Aristo.

"Good luck and be careful," the computer voice stated but this time with a degree of warmth.

“Thank you, we will.” Dr. Aristo started to walk down the corridor. Thomas counted his steps, just in case the lights went out and he needed to do his escape. It took forty two steps to go from the threshold of the elevator to the threshold of the next portal.

The next portal had no handle, no key and there was no numerical panel next to it.

Dr. Aristo placed her hand at the center of the door and the door opened with a hiss. “Quick now.” A wave of air conditioned air flowed past them as they stepped through the portal. They both stepped lively and the door hissed shut behind them.

They were now standing in a chamber that did not measure more than 5 meters by 5 meters with the *Tetrahedral* at its center. Except for the susurration of the air conditioning there was no other sound to be heard.

The *Tetrahedral* appeared much larger in real life than in the pictures he had seen of it. Although it was extraterrestrial in origin, it did not seem menacing. Dr. Aristo stepped out of the way and with her hand motioned Thomas to walk around it. “Just don’t touch its edges. The edged are one molecule thick and sharp as hell. They will cut your fingers right off.”

Thomas walked slowly around the *Tetrahedral*. He watched as the dot walked around the three faces.

“May I touch?” Thomas asked.

“Sure I have touched it on many occasions but nothing will happen …”

So he touched it and the one dot became two. Thomas stumbled back in surprise bumping into Dr. Aristo.

“I don’t understand, I have touched it so many times before and nothing happened.” She stepped forward and touched the *Tetrahedral* ever so carefully, but nothing else happened.

She turned to Thomas and said “touch it again.” He did and the two dots became four. The four dots marched around the *Tetrahedral*.

“You must have the magic touch …” said Dr. Aristo enviously.

“Should I touch it again?” Thomas asked.

“No … at least not today. “

As they watched, the four dots merged into two dots. Marching once around and then the two merged into one again and that singular dot marched monotonically around the *Tetrahedral* like before. After one cycle it disappeared.

They both watched the *Tetrahedral* for a long period of time but no dots reappeared. All four faces of the *Tetrahedral* just remained blank

“Thomas, let’s go up to my office. We need to try to sort this out!”

Chapter 22 – I Just Don’t Understand

Penny was still not back from the doctors when Dr. Aristo and Thomas returned to the Director’s office. They decided to sit around the small circular wooden Teak table in Dr. Aristo’s office. She left the door ajar so that she could see out to Penny’s desk.

There was a bottle of mineral water and glasses on a silver tray at the center of the table. Dr. Aristo reached to the center of the table, opened the bottle and poured two glasses of mineral water. They sat silently for a minute or two sipping the water.

Dr. Aristo spoke first. “I just don’t understand …” She left the sentence hanging.

“ … why the *Tetrahedral* responded to my touch and not yours.” Thomas said.

“Exactly … I have touched the *Tetrahedral* countless times before and nothing ever happened. You touch it once and well … the *Tetrahedral* comes to life.”

Thomas sat quietly. Over the past few years Thomas had gotten to know Dr. Aristo quite well and felt at that moment it was best to let her vent before he spoke. She could get quite snippety when she was frustrated, and at this particular moment she was indeed very snippety.

"Another thing is … well … the chamber the *Tetrahedral* is two floors down in the subbasement, surrounded by thick concrete walls and is itself a faraday cage. How could any signal find its way into the chamber?"

Thomas took another sip of his mineral water before he spoke.

"Perhaps the message is preprogrammed into the *Tetrahedral*? Perhaps it doesn't need a signal from the outside world?"

"Perhaps it is preprogrammed, but that doesn't explain why your touch activated it and not mine." Dr. Aristo took the cold glass of water and pressed it against her forehead.

Thomas tried to assuage her frustration while being diplomatic. "We could speculate about this for days without being able to resolve this. Why don't we just accept the fact that it has responded to my touch and try to figure out what to do next?"

"It seems particularly unfair that I have had the *Tetrahedral* under study for so long and yet the first time you view it and touch it, the damned thing comes to life!"

Thomas set down his empty water glass onto the table. “I agree it’s not fair … but the important thing is that the *Tetrahedral* is no longer inactive. Don’t you think we should think through what comes next? Should we not tell some other people what has happened?”

Dr. Aristo slumped back into her chair. “I don’t know what we should do. When it comes to the *Tetrahedral* I have come to mistrust what other people think and do.”

“I heard what happened to you a few years back when someone kidnapped you to try to get their hands on the *Tetrahedral.”* Thomas paused for a few seconds before continuing. “I think we should go back down and repeat what we just did … touch it once to see if it doubles in number, touch it twice to see if it doubles again … I want to see if it a simple geometric series. This seems harmless enough. And I think we should film this just to keep a record of what we are doing and how the *Tetrahedral* responds.”

“There’s a closed circuit camera system monitoring the *Tetrahedral* and the chamber 24/7.” Dr. Aristo said sternly. “The chamber is also designed to seal if the alarm is sounded.”

“Won’t we be trapped inside then?” Thomas interjected.

“Yes, until it is determined to be safe to open the chamber. There is an air lock pass through just in-case people are quarantined within the chamber.”

“It looks like you have thought of everything.” Thomas quipped.

“Not everything … obviously. Otherwise I would understand how the *Tetrahedral* communicates with the outside world and why the *Tetrahedral* responded to you and not me.”

“Are we going to dwell on this or are we going to investigate what happens when we repeat what we did an hour ago?” Thomas stood up. Dr. Aristo sighed and then stood up as well.

Just as they walked through the door Penny appeared from the elevator. She saw the two of them and smiled at Thomas with a smile more beautiful than he had seen from her before.

“Hi Penny.” Thomas said.

“Hi Thomas ... Dr. Aristo.” Usually she acknowledged her boss before Thomas, but not this morning.

“Are you feeling better?” Thomas asked her.

“She nodded, “much better …” Penny smiled again at Thomas with her extraordinary beautiful smile. She blushed. Her cheeks were much more rosy than usual. “Will I see you at lunch?” She asked Thomas.

“Yes …” Thomas nodded and smiled back at her.

Then Dr. Aristo and Thomas made their way to the elevator and down to the sub-basement and the chamber.

Penny watched as they walked away wondering how she is going to break the good news to Thomas.

When she got to her desk Penny looked around and seeing she was alone she started to cry. They were not tears of sadness mind you but instead were tears of great happiness. She and Thomas were lovers and their love was fruitful and bountiful.

Chapter 23- May We Be the First to Congratulate You!

It was the same procedure as before in the elevator and in a few minutes they were once again safely ensconced within the chamber standing before the *Tetrahedral*.

They watched the dot walk around the *Tetrahedral* for a few minutes before Dr. Aristo stepped forward and stood before the object.

“I hope I don’t regret doing this!” She leaned forward and touched the face of the *Tetrahedral*. Thomas waited a few seconds before he touched the next face on the *Tetrahedral*. It had dawned on him as they rode the elevator down to the subbasement that the key to activating the *Tetrahedral* was to not touch the same face but to touch the next face over. Without saying anything he then touched the next face over and stepped back to watch.

There were now two dots marching around the face, after one cycle there were three, then after another cycle there were five, then eight and then the dots paused in their march around the *Tetrahedral*.

“Go ahead” said Dr. Aristo and so Thomas stepped forward and touched the next face over thirteen times.

The dots became twenty-one in number. It was the Fibonacci series!

Thomas tapped the next face thirty four times, then all faces of the *Tetrahedral* lit up with a phantasmagorical light display. Thomas was so surprised he nearly toppled backwards. The display of colors went on for perhaps fifteen seconds.

It was anticlimatical when the faces of the *Tetrahedral* went totally dark.

“What now?” Dr. Aristo asked.

“I honestly don’t know.” They both stood watching the *Tetrahedral* for several minutes.

A deep sonorous voice was suddenly heard saying ‘*Greetings*.’ But there was something odd about the voice for it did not seem to come from without but seemed to come from within. Thomas realized that the voice was inside his heads.

“Hello,” said Dr. Aristo looking about the room bewildered.

Thomas smiled. Using his inner voice he repeated ‘*Greetings*.’

‘*Hello Dr. Tipler*.” Thomas reared his head back and opened his eyes wide.

Dr. Aristo turned to Thomas and asked him, “are you ok?”

Thomas pointed to his forehead “The voice is speaking directly to our brain …” he said to Dr. Aristo.

Again using his inner voice he asked ‘*how do you know my name*.’

‘Your brain is a simple electrochemical structure. We simply asked your brain to tell us who you are.’

Thomas spoke to Dr. Aristo. “Did you hear my thoughts and their answer?”

She shook her head.

The voice spoke again. ‘*Our conversation is one to one Dr. Tipler. No one else can hear your thoughts*.’

“Oh my!” Thomas sighed. The voice says we can only communicate one on one. “Try to speak to it Dr. Aristo …” A sudden fear rose within Thomas. What if the voice is not real? What if it is a figment of my imagination?

Dr. Aristo shook her head. “No … I have tried but no can do!”

The voice said to Thomas, ‘*turn around and face your back towards me*.’ Thomas did as he was told. ‘*Don’t show me how many fingers you are holding up but let your colleague see them*.’

He showed Dr. Aristo three fingers. Suddenly three dots appeared on the face of the *Tetrahedral*. ‘Three’ she said.

He held up five fingers … five dots appeared. ‘Five …’

He held up a fist and no dots appeared. ‘Zero!’ Dr. Aristo looked from Thomas to the *Tetrahedral.*

The voice spoke again. ‘*As long as you are close enough to me we shall be able to communicate. Can you be our interlocutor*?’

“*Interlocutor*?” Thomas thought.

‘*The person to whom we shall communicate with*.’

‘*Perhaps*’ Thomas thought ‘… *perhaps. I need to think about that*.’

‘*Please do … we think you are someone whose judgment we can trust*.’

Thomas spoke to Dr. Aristo. “They want me to be their interlocutor.”

Dr. Aristo smirked. Why him and not me?” She thought.

Then inside her head came a voice. ‘*Please Dr. Aristo do not be difficult. He is younger than you are and if we are to have a second contact we would like it to be face to face. The journey to us is arduous. It is best someone younger comes*.’

Dr. Aristo said aloud “Second Contact!”

“What?” Thomas asked her.

“They said they want a face to face meeting as a Second Contact. If this is a Second Contact then it means there has been a First Contact!”

The voice inside his head then said ‘*yes there has been a first contact with humans many billions of your helios years ago*.’

“Did you hear their response?” Thomas asked Dr. Aristo.

She shook her head. Thomas repeated what he had just been told.

A thought suddenly came to mind. Thomas listened as the answer to his thought came automatically.

‘*We can communicate to your humans in any language spoken on your Earth. You still use electromagnetic radiation to convey information. This travels great distances out into space. We are educated and entertained by some of your broadcasts and concerned about your propensity for anger and war*.’

‘*I do not believe in anger and in war*.’ Thomas spoke with his inner voice.

‘*We know that and this is one of the reasons we have asked you to be our interlocutor. You are a kind and peaceful soul. We are a kind and peaceful civilization. We want to interlocute with someone who might perhaps be able to understand us*.’

Dr. Aristo broke his concentration and asked him to ask about the meaning of 450.

He used his inner voice to ask them and they responded '… *this was our way to get your attention. There is no additional meaning to the number 450*.' He conveyed their answer to Dr. Aristo and she was clearly disappointed. Dozens of academic papers were written on the meaning of the number 450.

Thomas smiled and thought '*so much for academics*.' Then he remembered they could read his thoughts.

The *Tetrahedral* responded with '*we try to avoid academics as much as we can. Academics recycle other people's work as their own. You are a scholar Thomas. We know you do original work and so we welcome you to our community. Our community is open minded and creative. There is no meanness and mediocrity to who we are and what we do.*'

'The voice inside his head then whispered quietly to Thomas. '*It is nearly lunch time Dr. Tipler. I believe you have a lunch commitment.*'

There was a pause then the voice continued. '*May we be the first to congratulate you!*'

Chapter 24 - Luck has Nothing to do With This!

When they got back to Dr. Aristo's office there was a note left on her desk by Penny saying that she needed to take a few days off. Dr. Aristo picked up her cellphone and immediately texted Penny "Hope everything is fine for you. Take as much time off as you need. Just tell me how you are feeling at least once a day." Penny responded immediately with a brusque thank you and a happy face emoji.

Dr. Aristo handed Thomas the note and then told him that she had given Penny a few days off to deal with her 'morning sickness.' Thomas was oblivious to what this meant … he said he would call Penny later in the day to see how she was doing. When he call her later around six, Penny did not answer his call. She had expected him to call around noon and so was disappointed with him. He called once an hour on the hour. When Thomas texted Penny around ten that evening, she texted back an hour later to say she was going to bed and could he give her a few days privacy.

Thomas being so preoccupied with the *string of pearls* and the extrasensory communication he had that day with *The Tetrahedral*, he felt that his relationship with Penny would have to take second place. There were more important matters before him at the moment.

Dr. Aristo suspected there was more to Penny affliction than Thomas realized. But she let the matter slide as she and Thomas discussed his extrasensory communication with *The Tetrahedral*, and what they might do next.

“Should we talk with Avi?” she asked Thomas.

Thomas pondered this question for a moment before answering, shaking his head. “If we talk with Avi .indubitably Avi will talk with someone else and well, two friends will tell two friends and so on and so on ,,, and well before no time everyone will know.”

“Are you saying we should keep a lid on this?” Dr. Aristo asked Thomas solemnly.

“At least until we have sorted a few key things out.” He responded.

“Such as?”

“Whether they are friendly and …”

“And what?”

“Isn’t it obvious? What are their intentions?”

Dr. Aristo sat behind her desk and ushered Thomas to sit. “Let us sort on some questions and then go down and *interlucate* with them.”

“Does such a word exist?” Thomas guffawed.

“I don’t know … I just made it up!” Dr. Aristo smiled. “Just imagine that, you are communicating with an extraterrestrial civilization!”

Thomas suddenly got cold feet. “I didn’t mind it when it was happening but now sitting here thinking about it, I don’t know if I want to do this …”

“What if you say no to them? How might they react?”

“That’s a very good question, which may perhaps lead to the question of empathy. Should we not begin by seeing if they are emphatic? That would answer many questions about who they are and what their intentions are.”

“And how do you propose we test their empathy?”

Thomas slowly said. “By me suggesting I am not the man for the job of being their interlocutor.”

“Should be go down and ask them that now?” Dr. Aristo asked him.

“Why not … and I suggest you send me in alone to do this and you can observe from afar how they take this.” He spoke cautiously as he said this.

“Can I suggest something?”

“Sure …” He said brusquely.

Dr. Aristo ran her hand through her hair. “Maybe before you try to test their empathy you can ask them a handful of important questions?”

“Such as …”

Dr. Aristo leaned forward in her chair and placed her elbows on the desk to balance her head on her hands. “Where they are from for starts?”

Thomas felt sure of himself. “I bet you Tau Ceti …”

“So you say.” She waved one of her hands.

Thomas clapped his hands together. “Maybe we can reverse the roles?”

Dr. Aristo leaned her head on her right hand and brought her left hand silently down onto her desk. “Reverse the roles?”

“Yes … I will merely say we think they are from Tau Ceti and see how they respond.”

“They could always say they are but be lying.”

“Why would they lie?” Thomas asked incredulously.

“To protect their home planet!”

“Protect them from what. Surely they know humans are incapable of interstellar travel!”

“Yes maybe today but what about a century from now … or a millennium? Human civilization has a long collective memory.”

“You are making sense … as always. Why don’t I say we believe you have traveled here from the Tau Ceti planetary system to escape the fact your star is near the end of its days and see what they say.” Thomas queried.

“You are throwing quite a few of our cards face up on the poker table!” Dr. Aristo waved her hands across her desk for emphasis.

“This isn’t a game of poker. What we have here is not a zero sum game. They have been here for many millennia. If they meant us harm they would have done that a long time ago. I think it os more like a Nash Equilibrium. They want something from our solar system and this is why they have stayed her for so long. ”

Dr. Aristo paused for a good half minute before she said“I wonder what they meant by humanity being a class 4 civilization. Does that make them a class 1 civilization?”

“That is a good question that we might ask them today.”

“Let us choose maybe four or more questions for you and then go back down to the chamber.”

“I think we have three already … are you from Tau Ceti? How long did it take you to get here? How long have you been in orbit around then Sun? The fourth question I think we should ask is what are your interests in planet Earth?”

“Interests?”

“Doesn’t interest sound less threatening than intentions?”

“I guess so.”

Dr. Aristo pushed back from her desk and stood up. As she walked past Thomas’ chair he remained sitting. “If you prefer we can do this tomorrow sometime?”

Thomas looked up at her. “There is something to be gained by showing them we are not afraid.” Thomas said this with a feigned bravado, as much to convince himself to move as to convince Dr. Aristo he was ready for this. She placed a hand on his shoulder and said “I have confidence in you. Don’t be afraid.”

He looked up at her and then slowly stood up. She let him lead the way to the elevator. As they went down to the subbasement they did not say a word nor even look at each other. When the door opened she got out first but he stayed standing in the elevator.

Thomas looked at her and said, “If anything goes wrong I will put my hands behind my back and clench my fists.” Then he stepped out of the elevator and stopped.

The computer interrogated them again and then let them pass. Thomas walked past Dr. Aristo to the next door. She stood a pace behind him. Once again she placed a hand on his shoulder and this time said “good luck!”

The door opened just as he said “luck has nothing to do with this!”

The door shut behind him before she could respond. Thomas was now alone with *The Tetrahedral*.

Dr. Aristo watched the two *interlocute*. For the first few minutes Thomas’ body language was tense, then you could see a specific moment when he started to relax. Then he started to walk around *The Tetrahedral* mentally asking it questions. He nodded and smiled a number of times and frowned a few times as well. But the smiles greatly outnumbered the frowns.

Together they *interlocuted* for over an hour, far longer than Dr. Aristo had expected them to.

Chapter 25 - They Don't Represent a Threat to Us Do They?

The James Webb Space Telescope crew, the *Webbies*, had been keeping a close and careful eye on the *string of pearls* in its orbit around the Oort Cloud. It passed on a descent through the ecliptic without any noticeable change to its characteristics. The *string of pearls* still went through its normal 450 thing like clockwork. It was as if it were a machine on a set program on standby mode.

When the White House asked NASA for its weekly briefing on the *string of pearls* the President grew impatient with the no noticeable change he received in these briefings. The press were beginning to wane in its interest in the story of extraterrestrials and the public was tired with the stories. They wanted some fresh news! So being an impulsive sort of leader, the President decided to get out from behind his desk and go visit Dr. Aristo and Thomas at the Astrophysics Institute.

Just so that they did not pull a fast one on him, the President decided not to tell anyone where he was going until Air Force One was airborne. Only John F. Kennedy ever played this stunt with the flight crew of Air Force One when on the second week of November 1962 he hopped aboard and decided to pay NASA an impromptu visit to see how the Saturn rocket program was coming along.

The President arrived at the front door of the Astrophysics Institute without alerting anyone he was coming. Talk about setting the fox among the chickens. First came the Secret Service entourage then his assistants and then the President himself. Dr.

Aristo had perhaps a ten minute warning the President was coming. The Institute went into lock down.

When the President arrive Dr. Aristo invited him into his office and got her temporary secretary to set out in search of Thomas. He was found in the control room in a video conference call with the launch crew for SoPBSI – Six which was to be a lander. They had included a green-blue laser at his recommendation and he and he alone was to program they lasing of the instrument.

When it was whispered in his ear that the President had arrived Thomas cut the video conference call with the launch crew short, without telling them why, then he scurried to join him in Dr. Aristo's office.

When they entered the room the President did not stand up in his chair but instead extended his hand to Thomas. "How have you been Thomas?"

"Very busy Mr. President." Thomas walked over to him and shook his hand.

"So I hear. Dr. Aristo tells me that you are almost ready to launch SoPBSI – Six."

"Yes, we are. The launch window opens in forty two hours."

“I understand this spacecraft is to set down on the surface of the central feature.”

“That is what is planned.” Thomas responded

“Your report to us tells me that the central feature is a Dyson Sphere made up of a Graphene.”

“That’s correct.”

“My people tell me you can’t really land on Graphene can you?”

“No we can’t land, but we do plan just to set the SoPBSI-6 spacecraft to hover a few centimeters away from the surface of the Dyson Sphere. The Dyson Sphere is actually a Graphene-Gold composite structure. We believe it is a solar sail that has been closed up. Sort of like a sail on a sail boat gathered up when not in use. ”

“So what’s with the blue-green laser? Are you planning to do the Auric Goldfinger thing and cut your way in?”

“Auric who?”

“You know, James Bond … Double O Seven … Goldfinger?”

“Oh … that’s many decades before my time Mr. President.”

“Mine too Thomas … but I still try to enjoy the culture.”

“That’s probably why you are the President and not me …”

The President chortled.

“The blue-green laser may prove to be useful in many ways. It’s not very powerful. Just a few watts. ” Thomas said this hoping that the President would let the matter of the laser drop. He did and moved onto other matters.

The President was an old hand at playing his hunches and so he did. “I have heard … they are rumors mind you … that your *Tetrahedral* has done something.”

Dr. Aristo flinched which was ‘the tell’ the President needed to continue his line of questioning. “You know you are supposed to tell us what’s going on.”

Dr. Aristo sighed while Thomas stayed quiet. The President looked at the two of them. Then said “Well!” Impatiently.

Dr. Aristo started to speak hesitantly. “We really don’t know what to make of it.”

“Of what?”

“We saw dots so we touched the *Tetrahedral* and more dots appeared.”

“Is that all?”

Thomas spoke up. “Then it gave us a mathematical puzzle to resolve … Fibonacci’s series.”

“And you solved it?” The President asked.

Dr. Aristo answered him. “Yes, and then well it started to communicate.”

“Communicate? How through dots?”

“It has the ability to speak directly into our minds.” Thomas said.

“What … and you understand the thing?” The President sounded distressed.

Dr. Aristo spoke next. “Yes, they have been listening in to our radio and television broadcasts and so they can communicate in English.”

The President nearly fell out of his chair when he heard this. He stood. “So they are communicating to you in English. When did this start?”

“Just a few days ago.” She answered, thinking a few days is better an answer than a few weeks, for it was now over two weeks since their first interlocution.

“What have they asked about? What have you communicated about?” The President started to pace the office articulating with his arms as he spoke.

Thomas spoke. “I am the person they have asked to talk with, and we have not talked about much Mr. President.”

He turned suddenly to face him. “Such as?”

“Scientific stuff mostly, and a little about culture and the like. They have not asked us any difficult questions and we have stayed light and pleasant in our questions to them. They have been watching us for a very long time and so they seem to know all about human beings and the way we live.”

“Why aren’t you keeping me updated on this?” the President asked sternly.

“We are trying to sort out many things at our end Mr. President.” Said Dr. Aristo.

Thomas interjected to say “We want to keep you informed but with good information and not speculation.”

The President smirked. “And what have they said?”

Thomas responded. “They say they come to our solar system from Tau Ceti. Tau Ceti is twelve light years away from our Solar System. It took them a billion years to get here.”

“What! A billion years to get here!”

“They hitched a ride here on a Brown Dwarf star. That’s what is in the central feature. Quite clever of them to use a Graphene-Gold Composite solar sail as a Dyson Sphere!”

“So you’re telling me they sailed here!” The President asked incredulously.

“Yes, using a solar sail.”

The President nearly barked this question. “And what else?”

Dr. Aristo added, “ … and they have been in orbit around the Sun for at least a billion years.”

“Another billion years!”

“Yes, they seem to be a very patient civilization.” Dr. Aristo said this and glanced over at Thomas who nodded his understanding.

Dr. Aristo asked the President. “Would you like to see the *Tetrahedral*?”

“You damn well better show it to me, Dr. Aristo.”

“Just a word of caution, Mr. President.” Thomas exclaimed.

The President turned to face him. “And what’s that Thomas?”

“Remember the *Tetrahedral* seems to be able to read minds.” Thomas declared firmly.

“Well that’s just fine isn’t it. My mind is full of my concerns about the *string of pearls* and also full of our discussions about what to do about it.”

“Perhaps you should not visit the *Tetrahedral* Mr. President. Here let me show you it by camera.” Dr. Aristo extracted the remote from her top desk drawer and pressed the on button. The screen sprung to life but the *Tetrahedral* appeared inert.

“They have not asked to meet with anyone else. They only seem to want to talk with Thomas.” Dr. Aristo said.

“Are you telling me they only talk with Thomas?”

“Yes, Mr. President. They only seem to want to talk with me.” Thomas responded.

“Oh my then they will know what we have talked about today.”

“Perhaps I should leave while you talk things over with Dr. Aristo?” Thomas offered.

The President walked over to Thomas and shook his hand. “I think that would be a good idea. I am sorry I have been so abrupt. I have every confidence in you Thomas.” His words were spoken in a warm and convincing fashion.

As Thomas turned to leave the President asked him a few final questions directly. “How often do you communicate with them?”

“On average once a day?”

“And for how long?”

“Perhaps an hour or so never more than two. It tires me out quickly. Then Dr. Aristo and I meet to debrief.”

“I see … thanks Thomas.”

That was his queue to leave. He went and sat in his own office, reading through some of his written notes about his interlocution with the *Tetrahedral*. It was at least an hour before his phone rang. It was Dr. Aristo. “You have his permission to continue what you are doing.”

“Who said I needed his permission.” Thomas responded.

“He is very angry at me for keeping him in the dark.” she said.

“They don’t represent a threat to us do they? They mean us no harm. We are just doing our jobs.” Thomas was annoyed that the President had visited unannounced.

Dr. Aristo could hear this in his voice. “I have promised him weekly in person updates and he has in turn promised he won’t drop in again unannounced.”

“Now can we get back to our work?” Thomas asked.

“Are you up to interlocuting with them today?”

“I think so.”

“You don’t mind if I stay in my office and watch by remote?”

“Not at all.” Thomas got up and made his way down to the Chamber.

When he arrived they were happy to see him and as they interlocuted together they understood what he had been through with the President.

"*You humans have nuclear weapons and other weapons of mass destruction, and so you pose a threat to our existence*."

"*But we do not view you as a threat*." Thomas replied with his inner voice.

"*That is something you understand. But is that something your President understands, or the leaders of countries on Earth who have nuclear weapons?"*

"*I guess I can't speak for them can I*?" Thomas thought.

"*No you can't Perhaps there is something we can ask you to convey to your President*?"

"*What is it that you want me to convey*?" He pondered.

"*When we arrived in your corner of the galaxy our presence inadvertently dislocated a number of large icy bodies in what you call the Oort Cloud. We did not realize this had happened until it was too late."*

‘*Too late?’*

‘*Yes, one of these icy bodies struck the fourth planet from Helios and altered that planet’s magnetosphere, its atmosphere, its lithosphere and its biosphere. Before this impact event the fourth planet from Helios was a thriving planet*.’

“*So you are saying that if you are threatened …*”

‘*Our automatic systems will defend us in any way necessary. We cannot reprogram them. That is what our defensive systems are designed to do*.’

‘At the moment I don’t know what to think ...’ Thomas wondered. “*On the one hand you seem a peaceful civilization, yet on the other hand you might be our undoing*.”

‘*Just think good thoughts …it is best that you think just good thoughts …*’ was their response.

And for the rest of their session this is what Thomas did.

Chapter 26 – A Perfect Moment

They met early next morning at the park. It was Penny's suggestion and it would be at the park they had walked together for the first time. Thomas had not seen her for two weeks and she had not talked with him on the phone. They had traded texts. His texts to her had been open and direct but her texts back to him were evasive. He had asked her many times what was ailing her. Time and time again she would not say. He began to fear that she was dreadfully unwell with a terminal illness.

He had arrived early and waited for her at the bench they had first sat at in the park. Penny arrived fifteen minutes late. He was going to give her another five minutes before texting her.

"I am sorry I am late." She looked tired, as if she had not slept.

"That's ok Penny, no need to apologize."

"I had a light breakfast but I still threw-up." She put her hand over her mouth and gagged.

"Are you feeling better?" He sounded worried.

“Yes, much better. I must look like a wreck?”

“You look beautiful.” Thomas said but not very convincingly.

Penny sat far from him at the opposite of the bench. He looked at her but she did not look at him. They both felt it was going to be an awkward meeting for the two of them.

“I miss you,” Thomas said to Penny.

“Do you” Penny interjected back.

“Yes, I do. I have been very worried about you.” Thomas said quietly.

“Have you.” She looked up at him, then after a few seconds dropped her head again. He could see tears welling up in her eyes.

He knew not to crowd her, but also felt he had to show her he cared for her. He shifted closer to her, now sitting at the half way of the bench. He set his hand on the bench next to her, offering her a chance to reach out to him. She did not reach out to him. The exuberant Penny that he had grown to know had disappeared and was now replaced with a different person altogether.

He whispered to her, “I love you Penny.” This was the first time Thomas expressed this emotion to Penny. A tear began to form and roll slowly down her cheek. “Tell me what’s wrong.” He whispered.

“Nothing is *wrong* … nothing.” Now more tears were welling up.

“If nothing is wrong, why are you so upset?”

“Hormones …” she whispered.

“Why have you stayed away from me for the past two weeks?” Thomas asked her.

“I needed time to think.” She responded.

“Think about what?” Thomas turned to face her.

She moved her hand and placed it on his. Her hand was cold as ice. Gallantly he placed his other hand atop hers hoping to warm hers. “You hand is very cold Penny. Tell me what’s going on!”

She looked up at him. "I missed my period …"

"Oh …" Thomas sounded surprised.

She looked sternly at him. "My doctor says I am pregnant."

Thomas' face suddenly went flush. "Oh my …" Instinctively Thomas leaned forward and gave Penny a big hug.

She wrapped her arms around him and started to cry. "I am so sorry … I can't seem to stop crying. My doctor says it's the hormones …"

"Penny you do not have to apologize." He whispered into her ear. "Now we both have something wonderful to look forward to."

"Do you want us to keep the baby?" She asked timidly.

"Yes, of course. It is our baby …" He hugged her even tighter.

She eased back on her hug and looked him in the face.

He smiled “You will make a wonderful mother.”

“And you a wonderful father …” she whispered into his ear.

She leaned forward and she kissed him passionately. Her wet face pressed against his dry face.

For both of them it was a perfect moment.

Chapter 27 – I Need You.

Dr. Aristo and Thomas had established a routine of interlocution with the *Tetrahedral.* Each morning from 9 to noon they would sit in her office to discuss how he would communicate with the *Tetrahedral*. Then they would break for lunch and precisely at 1 each afternoon he would enter the chamber and spend about an hour in interlocution. They tried to make it a routine and they also tried to not tire Thomas out. They found that after ninety minutes or so his mind would begin to wonder and the interlocution would wonder as well. Dr. Aristo and Thomas had both agreed that he would only interlocute with them if he was at the top of his faculties.

Thomas did not look forward to that afternoon's session with the *Tetrahedral*. He had arrived an hour late with Penny gripping firmly at his arm. Penny had gone in to see Dr. Aristo and Thomas had let the two women talk for as long as they needed. He had gone to his office. Penny wandered into his office around 10 and sat in the chair in front of his desk.

"She is ready to see you." Penny said.

"Is everything fine?" He asked her.

"With the boss?" She jested.

Thomas nodded.

Penny smiled. “She has told me what you have been doing. It sounds very exciting and very dangerous at the same time. Why didn’t you tell me?”

“I wasn’t authorized to tell you.”

“A secret eh …”

“Yes, a secret. I am glad she has told you. Now it is not a secret between us. But you can’t tell anyone else.”

Penny reached down and rubbed her belly. “Not even or baby.”

When she said baby he stirred. Thomas looked at her now with twice as much love, now that there were two of them there in front of him. His face flushed and he remained silent for a moment.

“Your face is completely red!” She said.

“Yes, I can feel it.” He smiled back.

“I imagine you are one of those boys who cannot tell a lie.”

Thomas nodded.

“That’s good, we shall get along well, the three of us. You better go for your briefing.”

“You don’t mind I go?” He asked her. “I can take the day off.”

“No … it’s important.” Penny said firmly.

“You are more important than anything else …” said Thomas ardently.

“More important than the safety and wellbeing of humanity?” Penny exclaimed.

“Huh?” Thomas was taken aback by her response.

“By being the interlocutor you are responsible for the safety and wellbeing of humanity.” She said firmly.

“I have really not thought that was my role. If it is my role than I don’t want it. I don’t want the responsibility.”

Penny leaned forward and looked sternly at Thomas. “Whether you like it or not Thomas, we all have to take responsibility for things.”

He slumped in his chair and sighed. “My life is getting much too complicated. I just want to do math and physics Penny … and be a father to our child.”

She stood up, “on behalf of our child let me be the one to escort you to your day’s duty Thomas.” She set her arm out to him.

He got up and arm and arm they walked out of his office, down the hallway past the amused staff into the Director’ office. They stopped outside her office for a sec.

“Call me when your day is done and I will come and pick you up.” Penny said. “I will pick up a toothbrush for you, and swing by your house to say hello to you mother. I want to be the first to tell her. I want you to come stay with me tonight. I need. ”

Thomas gave her a hug and a kiss then Penny went home.

Chapter 28 – Why Do You Need to Judge Us?

That day's locution session with the *Tetrahedral* had not gone well for Thomas. Within seconds of him entering the chamber they knew that Penny was pregnant. They had tried to ask him about this but he asked them to respect his privacy.

'*This has nothing to do with our locution*' he thought.

He was astonished with their response. '*Quite the opposite, it has everything with what we have to deliberate."*

'*In what way?*' he queried.

'*We have watched your planet for a very long time. You humans are relative new comers to your planet and to the galaxy as a whole. Your species is only 150,000 of your Earth years old and your modernity less than 100. '*

'*Surely by now you have sorted out everything about life … how offspring are made and all that. I can't add anything to this*.' Thomas pondered defensively

'*Offspring are not the issue here. It is a question of what makes you a Class 4 Intelligence … nature or nurture/*'

‘*I am not sure what you mean by Class 4 intelligence. Isn’t this about intellectual ability? I take it you are Class 1 intelligence*.’

The tone of the Tetrahedral softened. ‘*We are in transition from Class 2 into Class 1. Class 1 is a perfect civilization. And it’s not about intellect. It is about empathy*.’

‘*Empathy*!’ Thomas was surprised.

“*Yes, empathy, sympathy, compassion, the very sentiments that builds social cohesion and hence the long term viability of a civilization. On a social scale you humans clearly lack this attributes. On the individual scale, such as with you, it is clearly present*. ’

‘*Reason doesn’t always prevail with humans*.’ Thomas

‘*We have clearly seen that. In the last hundred and fifty years you humans have killed other humans at a rate of one million a year*.’

‘*Must you judge us on our past*?’

‘*What else can we judge you by? Words are mere words. Actions are real*.’

‘*Why do you need to judge us?*’

‘*To see whether you are ready for a second contact*.’

‘*Can I ask you …*’

‘*When was our first contact?*’

‘*Yes …*’

‘*It was a long time ago … a very long time ago. Let us leave that conversation for another day … we are here for a second contact … it is important to us*.’

‘*And what is so important about a second contact*?’

‘*Let us leave that conversation for another day too … Can we ask you something*?’

‘*Yes, please*.’

‘*Tomorrow can you bring Penny so we can interact with the two of you together*?’

Thomas was surprised on their request and their use of the word interact. “*I will have to talk with her about your request. She may say no!*”

“*We know she will say yes …”*

After leaving the chamber he was very quiet. Dr. Aristo became quite concerned with his silence. He told Dr. Aristo they had asked something of him. “What did they ask you?” Dr. Aristo asked Thomas.

Thomas was defensive. “I need to sleep on this before I answer your question.”

Dr. Aristo was quick to say, ‘if you don’t tell me I will not let you into the chamber tomorrow.” Thomas shrugged his shoulders. “Don’t keep this from me!”

“I must go. Penny is waiting for me.” Thomas felt exhilarated and exhausted at the same time. He looked forward to spending an intimate night with her. He was also wondering how to break the request they had for her. They wanted to meet and talk with her. About what he was not all that sure. Inside he was deeply worried but Penny’s warm smile set his mind to rest.

Chapter 29 - Do You Really Want to Meet Them?

It had been a long and very interesting day for Thomas. Penny had spent that afternoon with Thomas' mother. Then she went home for a nap. Thomas' mother then phoned Thomas and the two of them had a long chat. He had wanted to come home to chat with his mother face-to-face about the good news, but his mother said that Thomas should wait for Penny to come and pick him up. He had her blessing to spending the night "*with the mother of his child*." Thomas' mother was happy she was to become a grandmother but was unhappy that they had made a baby out of wedlock.

Thomas promised that he would talk with Penny about getting married.

When Penny arrived to pick him up she looked like a million dollars. Her cheeks were rosy and she was very happy. "I should take a nap more often," she said to Thomas. Thomas on the other hand now felt somewhat tired. The Interlocution had been challenging and well there had been the stern warning from Dr. Aristo, and now this evening along with talking about their future together he had to find the means to raise the question of Penny coming to stand beside him in front of the Tetrahedral because they wanted to interlocute with her.

Penny had gone grocery shopping and together they prepared a simple dinner. This was only the second time he had visited her apartment but was the first time he had stepped foot in her kitchen.

During dinenr they talk pleasantly about how their relationship had flourished and how their love was sincere and how they had been blessed with a baby. For both of them their intimacy had been their first time and to make a baby so naturally meant in their logical minds their genes matched and therefore they were meant for each other.

After dinner they left the dirty plates in the sink. She seemed full of energy but he seemed exhausted, so she suggested they pour a nice warm bath and they both sit in it. It was a romantic interlude, rose fragranced bubble bath and all they both sitting in her bathtub, she reclined in from of him in his arms.

From his vantage point Thomas admire the beauty of her form. He tried to imagine where within her was her uterus. She let him soap her and then was the bubbles off of her. Then he went silent.

“What are you thinking about?”

“I am thinking how beautiful you are Penny,” he whispered into her ear.

“Gee Thanks. You are beautiful in my eyes too.”

"Really?"

"Yes you are. You are also very kind and gentle as well. I love the fact you are so kind and gentle."

"Thanks … my mother brought me up to be kind and try not to be forceful."

"She did a very good job. I had a nice chat with your mother today over tea and her cucumber sandwiches."

"You like them?"

"The cucumber sandwiches?"

"Yes … we had fun one day perfecting them, she and I. I suggested the dash of cayenne pepper."

"Oh so that's the secret ingredient! I asked her what made them taste so good but she said it was a family secret."

"We are now family aren't we." Thomas asked.

“Yes and no. Yes because we have a made a baby … but we also need to get married.” Penny covered her breasts in a modest fashion as she said this.

“Yes Penny let us get married.” Thomas put his hands over hers.

She turned to him and said “in a church?”

“In a church.”

“You’re Catholic aren’t you?” She asked him.

He nodded.

“So am I …” Penny smirked as she said this. “So much for original sin!”

“Does original sin really exist? … in the biblical sense?” Thomas asked her.

“Does it matter that the marriage comes after procreation?”

“I am perhaps not the person to ask. I am the father of our child, not a priest …”

“Do we have to tell them I am expecting?” Penny asked.

“That is a good question … I do not know whether it matters. We love each other and we have a baby that we will both love and cherish. That is what matters.” Thomas sighed deeply.

She leaned forward and turned to face him. “Is something wrong Thomas?”

Thomas looked away and to the right. Penny knew that meant that something had happened today that he felt troubled by. She took his chin in his hand and turned his head to face him. “What’s wrong Thomas?”

He was unsure how to proceed so he waited a few seconds before continuing. “Something happened in the interlocution today.”

“What happened?” Penny asked in a soft voice.

He dropped his chin again. “I don’t know if I want to tell you what happened.”

She lifted his chin up again. “Why not!”

“It has me very troubled.”

“Troubled?”

“They know we are expecting a baby.”

“What’s wrong with that? Babies are born every day of the week on planet Earth.”

“I think I might have to step out of being their interlocutor …”

“I don’t understand …”

Thomas softly placed his hands on both of her arms. “For your sake and for our sake.

“My God Thomas … tell me what’s going on!”

“They want to meet you?”

“Meet me! Why?”

“I don’t know. One moment we are conversing about empathy, sympathy and compassion and the next thing they ask that we both interlocute with them.”

“Well if we are only talking … what harm is there in that?”

“They can speak directly into our minds …” Thomas shared this fact with her.

“Is that how they … interlocute … by voices inside your head.”

He nodded.

“Can they read your mind too?”

“I have not asked them but I suspect they can. That’s how they found out your were pregnant.”

“Thomas you have told me they seem to be compassion souls.”

“They seem to be … but you see I really don’t know much about them except what they have told me … and well it could be the truth or it could be a fabrication.”

“Or somewhere in between …”

“What do you think would happen if I said no?” Penny frowned.

Thomas shrugged his shoulders.

“What would happen if I said yes?” Penny asked.

I haven’t told Dr. Aristo about their request and she has told me she will not let me into the chamber tomorrow if I don’t tell her about their request.”

“I wouldn’t worry too much. Knowing Dr. Aristo she will not let us do this.”

There was an awkward pause before Thomas spoke. “Can I ask you something … and answer it truthfully.”

“Thomas … how can you doubt what I say.”

“You might just say something so as not to disappoint me.” Thomas interjected.

Penny straightened her back, pulled her arms to her side and pressed her breasts out, “Like you I am as honest as the day is long.”

“Do you really want to meet them? Do you want to interlocute with them?”

Penny crossed her arms across her torso and nodded. “To be perfectly honest … yes I would.”

“Of you own free will?” Thomas asked.

She threw open her arms and made the sign of the cross over her sternum. “Cross my heart …” She started to stand. “I think we need to get a good night sleep.”

“Yes we do.” Penny lifted herself out of the bath by steading herself on Thomas’ shoulders. He watched her as she stepped from the bath. Then he stood up as she handed him a towel.

As he softly dried her back, he admired her obscured reflection in the steamed up mirror. He also wondered why they wanted to meet her and what awaited them.

Chapter 30 – An Urgent Update

He had promised Thomas he would keep a close eye on the neutrino stream from the *string of pearls*. It troubled him what he saw in his most recent analysis. To begin with he thought he had a drifting calibration issue, for the neutrino count started to drift – but it was a lopsided drift.

Normally with calibration issues the measure fluctuates around the mean. Some of the time the measure would be greater than the mean and sometimes the measure was less than the mean. But what he perceived coming from the core of the *string of pearls* defied normal calibration drift.

He perceived a slow and quasi-linear increase in the neutrino count. But this perplexed him for the count came from the heart of a dwarf star and it was conventional wisdom that dwarf stars have core reactions that are unchanging. They should not fluctuate nor vary on the scales of even billions of years.

Yet, his measurements showed the *string of pearls'* neutrino emission was in deed changing. The error bars for his data were large, even given the fact he was measuring neutrino emissions, so to be on the safe side he let the measure evolve over several weeks before deciding this was not a random fluctuation, but was in fact real. Then he sent an urgent update to Thomas! *Neutrino count up 30 percent …*

Chapter 31 – Don’t be Scared!

Dr. Aristo had a sleepless night. She was upset with Thomas. Why hadn’t Thomas told her what they had interlocuted about? Why didn’t he trust her? All during the night she vacillated between anger and empathy. Then she got up made herself some chamomile tea and waited for the dawn.

When you urgently wait for something to happen the psychology of time sets in … time always seems to pass slower when you have something pressing awaiting. When the eastern sky began to lighten it was bright orange and red storm clouds that drew into sight. By 6 am it had started to rain. By breakfast time it was coming down in buckets and by the time she made her way to the Institute it was a full blown thunderstorm. This didn’t help put her into a good mood.

She was soaked wet and cold when she arrived. As usual she was the first person in except for the security guard who let her in. God bless his soul – he had a hot cup of coffee waiting for her. His kindness warmed her cockles that morning.

When she got into her office it was not even 8. It would be a good half hour before Thomas was expected and so Dr. Aristo tried to sit behind her desk to do some boring administrative work but she could not focus. She ventured down to ask for a second cup of coffee. The security guard obliged her with a cup and a sugared donut. The touch of kindness softened her a bit.

She waited for Thomas in the lobby. When he finally arrived, five minutes late he had Penny at his arm. Dr. Aristo put off confronting Thomas until the three of them were in her office. They were silent as they took the elevator up together.

When they got to her office she closed the door behind them. Turning to Penny she asked …" and how are things with you Penny? Feeling better?"

"As well as can be expected." Penny put her hands beneath her tummy to emphasis the word expected.

Dr. Aristo smiled at Penny. Just as she suspected. Penny was pregnant.

Thomas turned to the Director and said "I would like Penny to stay and be part of our discussion."

Dr. Aristo walked to her desk and sat down. "Do you really want to stay Penny?"

Penny nodded.

Dr. Aristo invited Penny and Thomas to sit as well.

Then she turned to Thomas, leaned forward and all but growled. “And so Thomas … what is going on? Why did you not tell me what they had interlocuted with you?”

Thomas could see the black rings around her eyes. “You didn’t sleep much last night did you?”

“That’s beside the point Thomas … don’t try to change the subject. What is going on?”

“Dr. Aristo … I honestly don’t know. Something big I imagine.” Thomas alliterated his words carefully.

“Why do you say that?” Dr. Aristo snapped back.

“Our Japanese friend tells me that the neutrino count is up by 30 % and it is still rising …” replied Thomas.

“What, that’s impossible!”

“Not impossible … it is a good measurement … just highly improbable. There is a difference.”

“Don’t get smart with me,” she snapped. Dr. Aristo regretted saying this immediately after her words left her lips. “Sorry Thomas … I am very tired.”

“No need to apologize.”

“What I do know is that they want to speak to both Penny and I, at the same time.”

Dr. Aristo nearly jumped from her chair. “I can’t allow that under any circumstances.”

“I would like to meet them,” Penny said.

Dr. Aristo turned to Penny and declared “it is too dangerous.”

“I am prepared to take the risk,” Penny said petulantly

“We both are ready to take the risk. We talked it over last night …”

“I can’t allow it …” Just as Dr. Aristo said this her phone ringed. She grabbed the receiver and brusquely brought it to her ear. “Director here …” Her eyes went as big as saucers. “We are needed down in the control room. Something is happening!”

The three dashed out of the office to the elevator and then down two floor and into the control room. When they entered the normally dark control room it was alit with the projection from the camera aboard the SoPBSI-6 spacecraft. SoPBSI-6 was still some weeks off its rendezvous with the *string of pearls*.

What met their eyes was a remarkable sight of the solar sail being unfurled from around the dwarf star and the bright red glow from within the central feature.

“It looks like they have decided to set sail …” Thomas said just loud enough for Dr. Aristo and Penny to hear.

Dr. Aristo’s cell phone rang and she fished it out of her pocket. “Yah … Avi … what’s up? We’re kind of busy at the moment. What! I’ll call you back …” Dr. Aristo made a mad dash for the door and both Thomas and Penny followed her.

They were once again in the elevator this time rushing down to the chamber in the subbasement. When they finally arrived they found the chamber empty.

Dr. Aristo opened the door to the chamber and stepped into the empty room. A few seconds later Thomas and Penny joined her. Then Thomas smiled and took Penny’s hand.

Dr. Aristo turned and left the chamber. “Avi tells me that all the other *Tetrahedral* have also vanished too. I must call Avi back.” she said as she rushed to the elevator.

Penny wanted to leave but Thomas held her there. “They are still here.” Thomas whispered to Penny.

“How do you know?” Penny asked Thomas.

“Because they told me.” Thomas turned to Penny and hugged her. “They also say don’t be scared!”

The *Tetrahedral* slowly rematerialized in the centre of the room. Thomas looked over at Penny “They want us to touch it palm down together …” Penny slowly nodded. Then they leaned forward and together placed their palms side by side onto the surface of the *Tetrahedral*. There was a flash of blue-green light and both Thomas and Penny dematerialized along with the *Tetrahedral*.

All that was left behind in the chamber were their clothes and the things they had been carrying with them. What was truly odd was that their clothes were folded into two neat little piles with their underthings folded on top.

Chapter 32 – Be Patient … All Will be Explained in Due Time

Thomas and Penny were both fully conscious as they travelled the great distance between the Earth and the *string of pearls*. But it felt like an out of body experience. Their voyage seemed to occur instantaneously, but that was their *temps propre*. Special Relativity applied to the physics of their voyage over the distance of 2,172 Astronomical Units. There temps propre was just s split second,

In fact twelve and half days passed on Earth between their departure and their arrival at the *string of pearls*. Once their clothes were found, and they were said to be missing a systematic search was made for the two of them by thousands of searchers.

The headlines of the New York Times read '*People don' just get up and disappear … that's physically impossible.*' But that is in fact what had happened. Their clothes remained behind and they had vanished. Standard Operating Procedure among law enforcement agencies were to interpret the left behind pile of clothes as a message – we don't expect to be found. We chose to vanish. We do not want to be found!

When the President was informed of Thomas' disappearance, within minutes of its discovery and he declared a national emergency given Thomas' central role in the *string of pearls* matter. The President thought he might had been kidnapped by a hostile power and so he called in the F.B.I. and the C.I.A., and several of the other *alphabet soup* organizations at his disposal. He got a mountain of advice from them but little action, as there was little actionable intelligence for them to proceed on.

Dr. Aristo was distraught. One moment they are both there and the next moment they had vanished without a trace. She took it personally, feeling she had let the two of them down. Her prized *Tetrahedral* had also vanished without a trace. But at least in her measure of things it had vanished before Thomas and Penny had disappeared and so in a world of cause and effect, Dr. Aristo did not perceive that the *Tetrahedral* could have been responsible for the vanishing of her two colleagues.

In a depressed state, ten days later Dr. Aristo tendered her resignation as Director of the Astrophysics Institute. The Board wisely did not accept her resignation but granted her a month's leave to tend to her angst, and they also arranged that she spend it with her aged mother in a small township eat of Montreal.

For several months the *alphabet soup* crowd searched high and low and even clairvoyants chipped in, but it was to no avail. There were many false leads and uncorroborated sightings. Both Thomas and Penny were nowhere to be found.

For Thomas and Penny their *temps propre* was just the blink of an eye. One instance they are standing fully clothed in the chamber in the subbasement of the Astrophysics Institute and the next instance they were standing unclothed in the midst of a dream land.

They looked at each other and at their surroundings and immediately recognized who they were … they were Adam and Eve in Paradise. They felt no disorientation.

They felt no fear. Together Thomas and Penny experienced pure bliss on a trip that was beyond their imagination.

Their surroundings were splendid. It looked exactly like they were on a plush garden of plenty on Earth. There were birds in the air over head, a brook that flowed past them with fish and amphibians in it, there were creatures stirring in the canopy of the tall green deciduous trees that shaded them from sunlight. If they did not know they had just travelled 2,172 A.U. from Earth they could swear they were in a Garden of Eden on Earth.

And *They* were there to greet them. Not in person mind you but in the voices within their heads.

“*We needed some way to welcome you that would be culturally meaningful. Do you like your surroundings?”*

When she heard the voice Penny reacted modestly to cover herself top and bottom with her hands. She also hid herself behind Thomas, hugging him closely.

“*Yes … it is perfect. How did we get here?*’ Thomas interlocuted.

“*You call it quantum entanglement …we transported you here using quanta.*”

“*Oh my ... so this is teleportation ...”* Thomas thought in awe.

“*What you would describe as quantum tunneling. We folded space-time for you and the two of you passed from one space-time point to another in an instance*.”

“*I always thought you needed a massive object to distort space-time … for you to have an Einstein-Rosen bridge*” Thomas questioned.

“No ... you can fold space-time in a subtle fashion if you first know how to do it and then put your mind to it. Perhaps one day we shall explain how to do this to you. You seem to have the intellect to understand such things.”

“Thomas …” Penny whispered.

“Are you ok my love?” Thomas whispered back.

“I kind’a wished they let us keep our clothing.” She answered.

Thomas reached back and hugged her before asking. “Are you cold?” In actual fact she felt very warm.

“No … just ashamed.” She murmured back.

“Don’t be ashamed …” Thomas turned to look at her. “You are very beautiful.

There was a voice in her head. “*We had to leave your clothing behind so as not to meld their materials with your delicate epidermal tissue*.”

“Thomas did you hear that?” Penny asked.

“Yes …”

“*The dichotomy of your form is very practical*.”

“*Dichotomy …”* thought Penny.

“*Practical*?” Thomas wondered.

“*Yes, one of your form procreates, while the other provides. Very practical*.”

Penny slowly lowered her hands but stayed hidden behind Thomas. “Can I ask them a question?” Penny asked him meekly.

“Yes, by all means … yes!” Thomas reached back to move her forward. Penny stepped from behind him, no longer feeling the need to be so modest.

“*Penny do not be afraid of us. We mean no harm to either of you. We are happy you are both here and will provide for you anything you need or desire*.”

Thomas now stood beside Penny. “*Are there many of you?*” Penny interlocuted.

“*Yes, some are here and some are elsewhere*.”

“*Elsewhere*?” She inquired.

“*We are scattered throughout much of the galaxy. Some of us are visiting new star systems and some of us are making Second Contact with the many star systems similar to your own where intelligent life now exists*. T*his is our Second Contact with your star and planetary system*.”

“*When was your First Contact?”* Thomas asked.

“*We visited here about 3.5 billion of your Earth years ago.*   ”

“*You were here when life began on Earth!*” Penny wondered.

“*We are those who helped bring life to the third planet from your sun.”*

Frightened Penny interlocuted. “*You must be God*!”

“Steady now my love.” Thomas whispered

“No ... we were once very much as you now are ... but the passage of billions of your Earth years have seen us evolve into what we are today. You would call our home a Dyson Sphere when it is in orbit around your Star and not moving from one place to another ... and a stellar Engine when we use it for interstellar travel. When we are not moving from one system to the next we need all the output of the star to make planets. After we construct the planets we put life onto their surface and then take the planets with us to the next star system.”

“And what are you ... we haven’t seen you yet.” Thomas contemplated.

“Once you have settled into your new home you might meet us. It depends ...”

"Depends?"

"On your capacity to understand things. Who we are and what we are may challenge your capacity to understand. In the meantime this will be your home."

"And what if we do not like our new home?" Penny pondered.

"Then you can return back to Earth any time you want to. Just ask us and we shall send you back ... but ..."

"But what?" Thomas pondered.

"Yours is a Class 4 civilization. You do realize your species is doomed."

"What do you mean doomed?" Thomas interlocuted.

"Class 4 means you prey on your own kind ... this is in your nature as a species. We have been observing your species for far longer then you humans have existed. Even with the passage of time and biological evolution the species on your planet cannot seem to break out of this nature, to prey on thinbgs. If there was some hope you humans would become Class 3 perhaps your civilization would not be doomed ...but we see no hope."

“*In your measure, how soon before the end of humanity then*? Thomas interlocuted.

“Sooner than you think. When we met the two of you and saw how special you both are we discussed this amongst ourselves and decided to invite the two of you here to live with us. We would like your species to survive in one way shape or form somewhere in the universe. We find you both interesting and promising.”

“*Interesting and Promising*?” Penny pondered.

“*Yes, both interesting and promising. At the early history of our species we were Class 4 just like you are today and we nearly did away with ourselves, just like your species is about to do. Some of us managed to slip away into interstellar space in search for a quiet paradise and a meaningful purpose to our existence*.”

“*Do you find what you were looking for*?” Thomas wondered

“Yes ... isn’t it evident?. However we had to make it ourselves ... by changing the nature of who we were and how we thought. We notice that there is a human philosophy you call Existentialism. In a real sense we have become the ultimate existentialists. We perceive in the two of you the same qualities. You are both pacifists and vegetarians. You do not prey on others of your own kind or prey on other kinds. We sense that the two of you are by your very nature intelligent beings.

You have the potential to one day become like us. This is what makes you both interesting and promising. "

"*You are leaving our solar system aren't you*?" Thomas asked.

"*How do you know*?" For the first time Thomas could hear *They* sounded surprised.

"*Your neutrino emissions are significantly greater than your standby mode*." Thomas interlocuted. '*And we noticed you unfurling your solar sails*.'

"*You are very observant Thomas ... Yes, we are leaving Helios. This is why we would you like the two of you to come with us?*"

"*It depends where you are going and what you are doing.*" Penny asked. "*And are we to be your Adam and Eve?*"

'Yes ... you are correct to think you are Adam and Eve. Your child will be the first of your kind to be born in this ... your new world. We have stocked your planet with the best creatures from planet Earth, not all mind, you, but the best creatures nonetheless. How you nurture your child might set your kind onthe course of a Class 2 civilization based on your evolved nature.''

Penny hugged Thomas and Thomas drew her close. They remained silent.

“We will now visit some new star systems for the first time bringing life to those systems as well. When a new star system is born we visit it at the appropriate time to bring life to suitable planets. We are off to the star system you call epsilon Eradini.”

“*That then is your mission?*” Penny interlocuted.

“*Yes. In nine months you will bring new life into the world. Like you Penny, we bring new life into the galaxy. There was once an era when we were the only intelligent life in the galaxy. When it came to a point we nearly extinguished ourselves because of our nature we realized that if we ceased to exist there would be no intelligent life at all in the galaxy. We decided to change our nature and set sail for the many corners of the galaxy becoming harbingers of intelligent life.* ”

“*Won’t Penny and I be long gone by the time you get to your next star system*?” Thomas mused.

“*Our medicine is far more advanced than yours on Earth … it is up to you how long you might want to live*.”

Thomas whispered to Penny “I think we will both like it here …”

Penny whispered back “you mean the three of us …”

“*Do you want to know whether it is a boy or a girl*?”

Penny blushed. “*No. A little privacy would be in order.”*

“*We are so sorry … it is just that we haven’t had guest aboard in a very long time*.”

“*We are your guests*?” Penny wondered.

“*Yes you are … You two are some of the most exquisite and beautiful creatures we have ever encountered … and have invited as guests to join us on our journeys.”*

Something caught Thomas’ eye and he looked up to watch a male cockatiel fly over head with a female companion in trail. He looked past the two birds and saw the clouds and then peered deep into the sky trying to see what was beyond the clouds.

“*You are wondering what is above your head*.”

“*Yes … I am*.” Thomas responded. Penny looked up as he thought this.

“*You are inside one of what you described as one of the string of pearls. The outside is a thick layer of water-ice which acts as a radiation shield. Inside each of the six pearls are entire worlds that we have constructed. You are standing on a world that is very much like Earth. This is to be your new home*.”

“*You are indeed builders of worlds!”* Thomas declared in amazement.

“*Yes. After all billions of years is a long time to remain idle.”*

“*We both have a million questions …*” Penny wondered.

“*Be patient ... all will be explained in due time. You must be hungry and tired after your long trip. We have built you a home, inside of which you will find everything you will need to live comfortably. ”* “

As the voice finished saying this a ray of light shone down from above illuminating a simple abode ... and so Adam and Eve walked arm in arm to their new home.

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